MAY, 1962 • 35¢

AMERICAN Cinematographer

Magazine Of Motion Picture Photography And Production Techniques

Dramatic action shot for Columbia Pictures' "Experiment In Terror"

A. S. C. Recommendation No. 4

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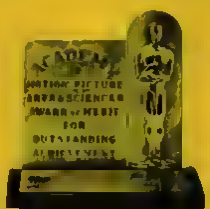
for a process of automatic selective printing presented to Technicolor Corporation and Laurie Atkin, James Dale, H. Peasgood, W. E. Pohl, H. E. Rice, John Rude, S. Witson

award

for an integrated sound and picture transfer process, presented to Technicolor Corporation and W. E. Pohl



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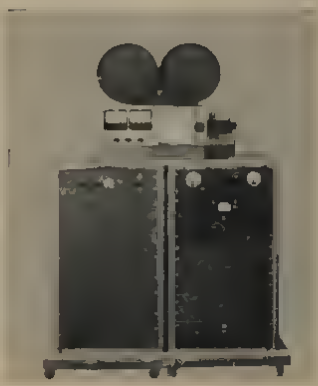

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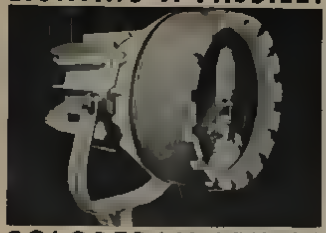

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ON THE COVER

REHEARSAL WITH CAMERA—Producer-director Blake Edwards (top right), dark glasses) rehearses Stefanie Powers for a scene in 'Experiment in Terror,' GeoErey Kale production for Columbia release starring Glenn Ford and Lee Remick Philip Lathrop, ASC, directed the photography about which a story appears in this issue beginning on page 288 (Columbia Pictures photo by Van Pelt)

AMERICAN CINEMATOGRAPHER, established 1920 is published monthly by the A S C Agency, Inc, 1782 N Orange Dr Hollywood 28 Calif SUBSCRIPTIONS United States And Canada, $4.00 per year, Foreign, including Pan-American Union, $5.00 per year Single copies 35 cents, Back numbers 45 cents, foreign single copies 45 cents, back numbers, 55 cents Advertising rates on application Copyright 1962 by A S. C. Agency, Inc. Second-class postage paid at Los Angeles, California

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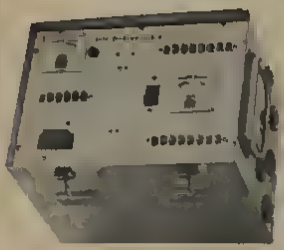

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INDUSTRY NEWS

News briefs of industry activities, products and progress

SMPTE's 91st Convention

Scientists and engineers whose research has developed movies and televisions from "flickers" to their present colorful worldwide art form and whose refined techniques are advancing the space program by transmitting pictures from satellites back to earth are meeting at the Ambassador Hotel in Los Angeles, as we go to press, for the 91st convention of the Society of Motion Picture and Television Engineers. The meeting will conclude on May 4.

Geared to the theme of "Advances in Color Motion Pictures and Color Television," the convention features 70 reports of researchers and scientists as well as 14,500 square feet of exhibit area displaying new motion picture and television equipment.

Keynote speech delivered at a get-together luncheon April 30th by Cinerama Executive Vice President Max Youngstein was on the subject of "Hollywood's Disregard of Research and the Price It Has Paid For That Disregard."

Climax of the convention will be Friday morning, May 4, at the session on "Motion Pictures and Television in Education and Industry" when a preview of "Friendship Seven," the color documentary of John Glenn's orbital flight of the earth will be screened. It will be followed with a panel discussion by Colonel John Powers of NASA, spokesman for the astronauts, and by E. C. Keefer and John Hynd of General Dynamics Astronautics Division, who will tell of how camera crews were stationed around the world to film the documentary flight.

•

Two Awards for Technicolor

Technicolor last month received two Technical Awards voted by the Board of Governors of the Academy of Motion Picture Arts & Sciences. The Class Two Award was presented to Wadsworth E. Pohl, H. Peasgood, John Rude, S. Wilson, H. E. Rice, Laurie Atkin, James Dale and Technicolor Corporation for a process of Automatic Selective Printing. This process employs a unique cueing distance counter combined with an automatic optical printer whereby scenes may be selectively deleted, shortened or interchanged for different versions of a motion picture without recutting the negative. The system is also applicable to the automatic production of fades and dissolves.

Class Three Award was presented to Mr. Pohl and Technicolor Corporation for an Integral Sound and Picture Transfer Process. This development combines sound track printing and developing with the three dye-transfer operations into a single integrated process. Mr. Pohl, who is Technical Director of the Motion Picture Division of Technicolor Corporation, accepted the awards at the Academy's annual Awards Presentation Ceremonies in Santa Monica, Calif., last month.

•

Academy Cites 20th's Research Department

The research department of 20th Century-Fox Studios was also honored at last month's Academy Awards presentations with a Class II Technical award. The Research Department, under the direction of E. F. Sponable and Herbert E. Bragg, and DeLuxe Laboratories, Inc., and assisted by F. D. Leslie, R. D. Whitmore, A. A. Alden, Endel Pool and James B. Gordon, was cited for a system of decompressing and recomposing CinemaScope pictures for conventional aspect ratios.

This system, which decompresses CinemaScope motion pictures to conventional aspect ratios, employs a special optical printer and auxiliary programming devices which automatically follow pre-selected action. Retention of the essential action may be accomplished by a static setting or by panning at appropriate speeds. The printer is adaptable to the use of a single

Continued on Page 268

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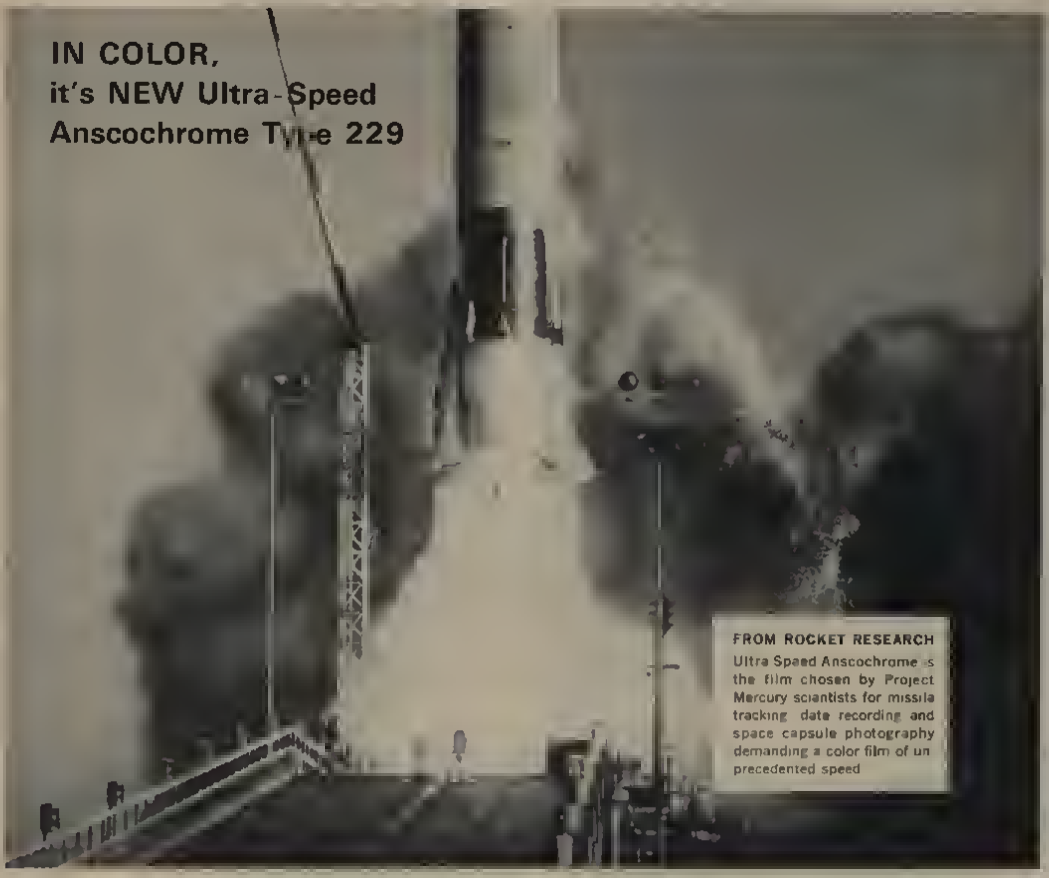
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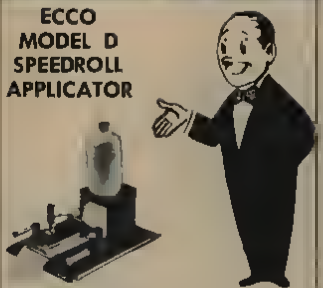

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INDUSTRY NEWS

Continued from Page 262

master positive film or, through a unique optical system, to the simultaneous use of separation masters, and produces a 35mm or 16mm dupe negative, or both.

•

College-made Films To Compete At Cannes

A film produced by a UCLA graduate student in the Motion Picture Division of the Theater Arts Department has been chosen as one of the two official entries to represent the United States in the short film competition at the Cannes Film Festival next month. The film, "Image of the Sea," a ten-minute study of the moods of the ocean, was produced by Richard Alan Gray of Kansas City, Missouri as a Masters Thesis film.

The second film designated for official entry is "The Sound of Speed," a 19-minute color film produced by Bruce Kessler and Michael Doyle of Hollywood.

The films were selected by the Committee on International Non-theatrical Events (CINE), a group of specialists from industrial, educational, religious, and scientific film fields. This group was organized at the request of festival officials to select and evaluate short film entries from the United States. The group also selects entries for the Venice and Edinburgh Festivals. Television films as well as theatrical shorts are considered.

Two other UCLA films have been designated to represent the United States at festivals this year. "Cross Country Runner," a comedy by graduate student Mark McCarty was an official entry for the West German International Short Film Festival in February. "August Heat," directed by Martin Zweiback, also a graduate student in motion pictures, received an official invitation to the Melbourne Film Festival which is to be held in June.

•

3-film, 3-screen 16mm System

An unusual 3 film, 3-screen color motion picture on the peaceful uses of atomic energy was exhibited in New York last month, during the annual convention of the Educational Film Library Association, there.

The special projection system, with interlock drive, double film magnetic sound reproducer and theatre playback facilities was developed for the Atomic Energy Commission by Reevesound Co., Inc., specialists in multiple image motion picture techniques.

Projectors used are Victor are Model 1600 16mm machines specially modified with remote controlled changeover dowsers and Reevesound sync selsyn interlock drive system. All machines are silent, running synchronously with a Reevesound studio reproducer that plays back a single 16mm magnetic sound track in the language of the host country.

The 10-minute film, shown simultaneously on three 12 by 16 foot screens in a theatre area accommodating 390 persons, serves as an exciting introduction to the United States Atomic Energy Commission's Atoms At Work Exhibit, a huge, transportable scientific laboratory featuring operating nuclear devices, which has toured several Latin American countries since 1960.

While the 3-screen system utilized in the film is similar to both the Cinerama and the Cinemiracle processes, Producer Thompson has used it with greater freedom than has been employed heretofore. Dramatic panoramic images may be projected across the 52-foot surface of the three screens, which are mounted side by side, or separate, repeated and continuous images may be projected synchronously onto the individual screens. The medium allows for unusual camera movement, the synchronizing of animation, photography, diagram and live action, and for extreme close-ups.

In spite of the special problems of editing and composition involved in this process and the discipline required of the film maker to see images properly related to each other, Mr. Thompson believes that the process, in which so much information can be transmitted dramatically in such a short period of time, has great possibilities.

•

Free Equipment Offer Terminated by F & B

The overwhelming response that followed the company's recent offer to supply Government Surplus motion picture equipment free of charge to non-profit educational, medical and religious institutions has caused Florman & Babb, Inc., New York to terminate the offer as of May 1st. All requests for equipment received after that date will not be processed, the company announces.

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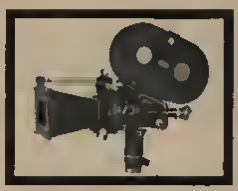

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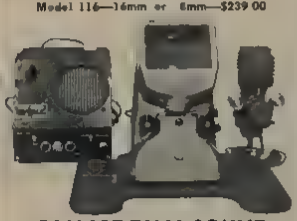

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William Daniels Re-elected President of The American Society of Cinematographers

Hal Mohr, Arthur Edeson, and Joseph Ruttenberg, Vice-presidents.

WILLIAM DANIELS ASC

William Daniels began his second term of office as President of the American Society of Cinematographers last month, following the Society's annual election of officers and members of the Board of Directors.

Other officers elected for the 1962-1963 term are: Hal Mohr 1st Vice-president, Arthur Edeson, 2nd Vice-president; Joseph Ruttenberg, 3rd Vice-president; Arthur Miller, Treasurer; Sol Halprin, Secretary, and George Folsey, Sergeant-At-Arms.

William Daniels' initial term in office as President of the cinematographers' Society was a progressive one which resulted in two major accomplishments: a new membership setup which will greatly benefit all active members of the Society, and establishment of the Society's Research and and Educational Committee. The latter, chairmanned by Walter Beyer assisted by Hal Mohr, researched and completed nine Technical Recommendations of general benefit to the motion picture industry.

Daniels is presently directing the photography of M-G-M-'s "Billy Rose's Jumbo," a circus picture starring Doris Day, Stephen Boyd and Jimmy Durante. Previously he had directed the photography of two episodes of "How The West Was Won," Cinerama and color production for M-G-M.

New Board of Directors members elected this year are Joseph Biroc, Lee Garmes, Ernest Laszlo, and Walter Strenge. Incumbent members of the Board include Robert de Grasse, Daniel Fapp, Milton Krasner, and Victor Milner.

Alternates are Harold Lipstein, Winton Hoch, Gordon Avil, Lucien Andriot, Philip Tannura, Lionel Lindon, John Arnold, George Clemens, Linwood Dunn, and Arthur Arling.

Following the general election of officers, ten committees were formed from among the membership as follows:

By-Laws: Arthur Miller, Chairman, George Folsey, Lee Garmes, Burnett Guffey, Ernest Laszlo, Victor Milner, Hal Mohr, Philip Tannura, and Paul Vogel.

Entertainment: Arthur Edeson and Joseph Biroc, co-chairmen; Ellis Carter, Daniel Fapp, George Folsey, Alfred Gilks, Milton Krasner, Ernest Laszlo, Joe MacDonald, and Charles Salerno.

Finance: Arthur Miller, Lee Garmes, Co-Chairmen; Charles Clarke, Robert de Grasse, Alfred Gilks, Burnett Guffey, Milton Krasner, Hal Mohr, Ray Rennahan, Harold Rossen, Charles Salerno, and Walter Strenge.

Membership: Sol Halprin, Chairman; Milton Krasner, George Folsey, Harold Lipstein, Hal Mohr, Ray Rennahan, John Seitz, James Van Trees, and Paul Vogel.

Public Relations: Joseph Ruttenberg and George Folsey, Co-chairmen; Charles Clarke, Lee Garmes, Milton Krasner, Pev Marley, and John Seitz.

Publications: Arthur Miller, Chairman; Robert de Grasse, Arthur Gavin, Alfred Gilks, Burnett Guffey, Milton Krasner, Hal Mohr, Ray Rennahan, Harold Rosson, Charles Salerno, and Walter Strenge.

American Cinematographer Manual: Arthur Miller and Walter Strenge, Co-chairmen.

Retirement Income-Insurance: Chas. Clarke, Chairman; Arthur Arling, Sol Halprin, Milton Krasner, Arthur Miller.

Publicity and Advertising: Stanley Cortez, Chairman; Charles Clarke, Robert de Grasse, George Folsey, Arthur Gavin, Lee Garmes, Burnett Guffey, Milton Krasner, William Mellor, and Harold Rosson.

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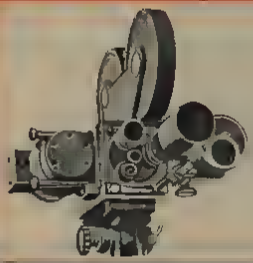

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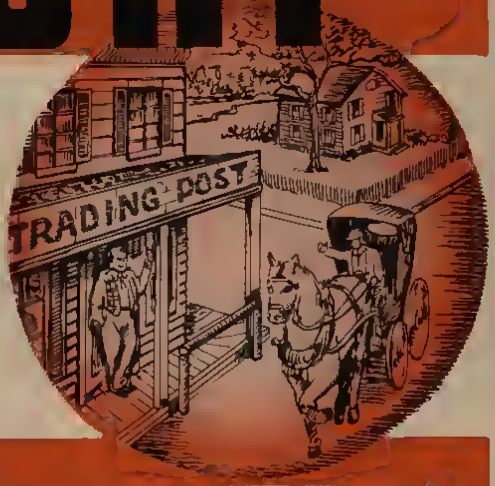

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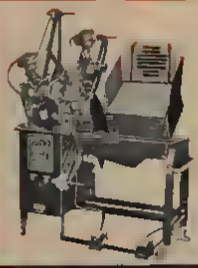

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A.S.C. RECOMMENDATION No. 4

Safe action and safe title areas for 35mm films for television release in black-and-white or color.

By WALTER BEYER
Chairman, A.S.C. Research and Educational Committee

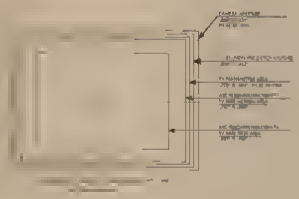

Fig. 1

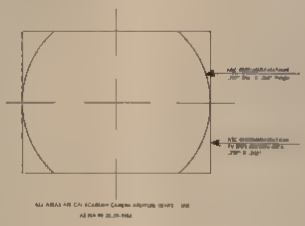

Fig. 2

THIS RECOMMENDATION by the Research and Educational Committee of the American Society of Cinematographers aims for agreement on the ground glass and or finder markings for all cameras used for photographing motion pictures specifically for television.

The former Research Council's RCIP No. 27 on "Safe Action" and "Safe Title" areas, prepared and first issued in 1956 and reissued in 1959, is no longer kept up-to-date and is now replaced by A.S.C. Recommendation No. 4 following a careful survey made with the full cooperation of all studio camera department heads and television network representatives.

Our survey revealed that the safe action and safe title areas established in 1956 are still in general use and considered fully valid for both B&W and color films as reproduced on home TV receivers.

1. Scope

1.1 This recommendation specifies the maximum dimensions for the safe action and safe title areas.

1.2 The dimensions of the ASA Standards for camera aperture, TV station projector aperture, and TV transmitted area are also listed as they are essential within the scope of this project.

1.3 Special considerations and dimensions for the review room projector aperture are given in the appendix.

2. Definition

2.1 *Safe Action Area* is that portion of the image inside the camera aperture within which all significant action should take place for "safe" reproduction on B&W and color home receivers.

2.2 *Safe Title Area* is defined as that portion of the image inside the camera aperture which will be reproduced on all home receivers without cropping of width or height.

2.3 *TV Station Projector Aperture* is defined as that aperture used in 35mm projectors at the TV station for telecasting 35mm prints.

2.4 *TV Transmitted Area* is defined as that portion of the image inside the camera aperture which is transmitted by the TV system.

2.5 *Review Room Projector Aperture* is defined as that aperture used in 35mm projectors for viewing 35mm prints specifically made for TV release.

3. Dimensions
(ASC Recommendations)

3.1 All dimensions and centerline information are combined and presented on drawings marked "Page A" and "Page B" as part of this recommendation (and reproduced here as Fig. 1 and Fig. 2).

3.2 *Safe Action Area* (safe composition area) shall be 0.757"x0.565" (plus/minus 0.002").

Note: For better protection of corner areas in B&W production and to compose somewhat more favorably for color home receiver presentation, NBC recommends curved sides for this area: 0.757" diameter x — 565" height. (See Fig. 2).

3.3 *Safe Title Area* shall be 0.621"x 0.466".

4. Dimensions (ASA Standards)

4.1 *Camera Aperture* for films for television shall be 0.868"x0.631" with the center line 0.738" from the guided edge of the film in accord with ASA Standard PH 22.59-1954.

4.2 *TV Station Projector Aperture* shall be 0.816"x0.612" with the center line 0.738" from the guided edge of the film in accord with ASA Standards PH 22.58-1954 and PH 22.95-1954.

4.3 *TV Transmitted Image Area* — The portion of a 35mm motion picture frame reproduced by a television film chain shall be an area of 0.792"x0.594" height in accord with ASA Standard PH 22.95-1954. The center of this reproduced image area shall coincide with the center of the camera and projector apertures as per 4.1 and 4.2 (above) which serves to locate the reproduced area relative to the film.

Appendix

Review Room Projector Aperture

A) For artistic composition and action reviewing of 35mm prints for TV release, the projector aperture shall be identical with the safe action area and either rectangular in shape 0.757"x 0.565", corner radii optional 0.125" maximum; or with curved sides (NBC Recommendation) 0.757" diameter x 0.565" height.

B) For laboratory print inspection of 35mm films for TV release, the projector aperture to be used shall be rectangular in size and identical with the TV station projector aperture (ASA PH 22.95-1954), 0.816"x0.612", corner radii optional 0.125 maximum.

Note The review room projector apertures (Figs. 1 and 2) must be centered with reference to the height of the image on the film, since the transmitted area and/or the TV station projector cannot be "framed." ■

CORRECTION

In the report on the A.S.C.'s Research and Educational Committee in our April issue (pp. 212) several lines in the list of A.S.C. Recommendations were inadvertently transposed. The corrected list is reproduced herewith.—EDITOR.

A.S.C. RECOMMENDATION #1: *"Screen Brightness— and Color Temperature Levels for Review Rooms"*
A.S.C. RECOMMENDATION #2: *"35mm Camera Aperture Dimensions."*
A.S.C. RECOMMENDATION #3: *"Focusing Chart for Daily Rushes."*
A.S.C. RECOMMENDATION #4: *"Safe Action and Safe Title Areas for 35mm Films for TV."*
A.S.C. RECOMMENDATION #5: *"Improvements for Black and White Film Presentation on TV." (DC Restoration Action.)*
A.S.C. RECOMMENDATION #6: *"Double Frame Camera Aperture Dimensions."*
A.S.C. RECOMMENDATION #7: *"35mm Cinerama Camera Aperture Dimensions and Angular Field Coverage."*
A.S.C. RECOMMENDATION #8: *"Aperture Considerations and Release Methods for Flat and Anamorphic Theatrical Pictures on TV."*
A.S.C. RECOMMENDATION #9: *"35mm Camera Aperture Dimensions."*

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GENERAL SYSTEM

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Joe Vadala, named Newsfilm Cameraman of the Year by NPPA sets up his Bolex in a Jerusalem street to get "establishing shots" for the documentary, "Way of the Cross" After seven weeks on location, Vadala said of Bolex, "A beautifully made piece of equipment"

Vadala moves in close as he shoots Franciscan fathers carrying the cross in the award winning epic for NBC News Viewing and focusing through the Bolex taking lens while shooting, he obtained the most complicated effects with precision

How NBC News used Bolex to shoot prize winning film

Mountain climbing is all work And when the climb is to film cloud effects and waterfalls, the cameraman wants a camera that is lightweight, compact and rugged He wants a Bolex "You don't need five men," Vadala said, "and you can set it as you climb."

Casting nets on the Sea of Galilee was a vital part of the film story and the scene was shot at various speeds to get the desired result. With a Bolex, speeds can be adjusted from 12 to 64 fps and can be reset while the camera is running

Temperature extremes may mean discomfort for the camereman but can't be allowed to interrupt the job at hand Bolex is unaffected by heat and cold and for that reason it has become a favorite among newsmen, explorers and scientists

Film narratives of this scope call for hundreds of detail shots, dissolves and zooms that can be cut into the story in the final editing This is why Prize Winner Vadala chose the versatile Bolex

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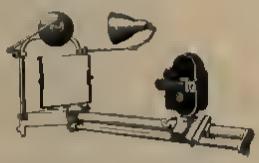
For Every Professional Effect

Bolex Tripod: Lightweight aluminum construction. Smooth action pan head with spirit level tells 135 degrees vertically. Nonskid legs. $99.50

Bolex Unimotor: Motor drives camera through full roll of film at constant speed. Batteries or AC current. $89.50

Precision-Ground Bolex Lenses. Switar 10mm f/1.6 wide-angle $149.50. Switar 25mm f/1.4 normal lens, $168.00. Switar 75mm f/1.9 fast telephoto $145.00.



Bolex 16mm Titler: Basic kit—optical bench, main frame, reflectors, title frame and cradle $180.50

The Bolex H-16 Rex with reflex viewing, variable shutter, 3 lens turret and Lytar f/1.8 lens costs only $450.00. Workmanship for all Bolex equipment is to the most precise tolerances on the 16mm market. Bolex lenses are matched for uniform sharpness, exposure and color rendition. Bolex cameras and accessories offer the professional utility many studios have paid thousands of dollars for. Write Dept. BAC-11 for literature and the name of your nearest Bolex dealer.

All prices include F.E.T. where applicable.

BOLEX

PAILLARD Incorporated, 100 Sixth Avenue, New York 13, N.Y.

Q & A

Technical Questions and Answers

Q.—*I bought a Norwood Director exposure meter in 1955. Since then new types of Kodachrome film have been put on the market. Do the original instructions for using this meter with Kodachrome still apply? Does the Colormatic feature still apply to Kodachrome regardless of the ASA speed of the film?*

The instruction manual for the meter states in effect as follows: Simply insert the Colormatic slide. It is unnecessary to then set the meter for film speed or use the computer dial—merely read directly the f/ stop indicated when the needle stops moving.

What, then, is the function of the different emulsion speeds of the Kodachrome films?—C. J., Kowloon, Hong Kong.

A.—You apparently have the Colormatic model of the Norwood meter, which has the range-change slide and the two-range calculator. This involves adjusting the calculator for the sensitivity of the film you are using, as expressed in ASA units, and using the calculator for every reading.

In cases where Kodachrome ASA 10 is used, a shortcut has been provided for users of this meter. An additional slide labeled Colormatic can be used instead of the range-change slide. An additional notation in the form of an f/ stop scale is provided on the face of the meter. Thus, when using Kodachrome ASA 10 film only, the meter can be used as a direct-reading meter. For all other films however, the range-change slide and the calculator must be used.

A new, improved model of the meter, known as the Norwood Super Director, affords direct-reading for all films.

Q.—*The nitrate base negatives of my first feature film, produced in 1946, have gotten partly sticky and cannot be unrolled without damaging the picture area. How can these negatives be made usable so that I may obtain a master positive then a dupe negative?*—T. N. D., Istanbul, Turkey.

A.—For the answer to your question we inquired of Kemp R. Niver of Hollywood, whose Renovare Company specializes in the restoration of old films and paper negatives.

"About eight years ago," said Niver, "we encountered a similar problem when we undertook to restore some old films from the vaults of the Academy of Motion Picture Arts and Sciences. We discovered that if we interleaved nitrate film with a special type paper, which was made available in strips the same width as the film, that the paper not only prevented the layers of emulsion from adhering, but also absorbed the sticky exudation. We have followed this simple but quite effective method for the past eight years, and a recent examination of the films so interleaved showed that rot and exudation had been completely arrested."

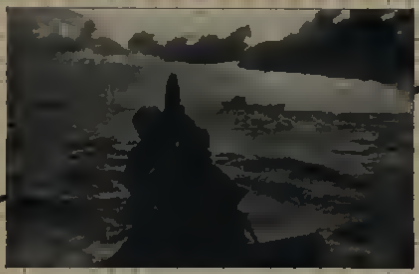
It is understood that the Hollywood Film Museum Associates are utilizing this method in the restoration of films and that persons interested in using the method may purchase the interleaving paper and use it, or contact the Hollywood Museum Associates, Hollywood, California, for the service.

Q.—*I would like your advice on the following two questions. 1) What is usually written first—the shooting script or the narration? 2) Is one-hour too long for a color documentary?*—J. C., Honolulu, Hawaii.

A.—1) In theatrical film production, the script is written first. In documentary film production the narration is often written first and the cameraman shoots the subject matter to fit it. 2) One hour is not too long for a documentary. However, it is not possible to accurately estimate how long a documentary should be, for this depends entirely on the subject matter and sometimes, as well, the market for which the film is intended. ■

FILMING A SPACE FLIGHT...

Birns and Sawyer equipment shoots 'round-the-world



TRINIDAD — Silhouetted against the dusk, cameraman films the tracking ship, Rose Knot, on its lonely vigil

CAPE CANAVERAL — Meanwhile back at the cape, this was the crew that launched Astronaut John Glenn into space

NIGERIA — Cameraman John Hynd and assistant catch ships of the desert instead of spacecraft as camel caravan passes tracking station at Kano

OMNITARS SHOOT BLASTOFF — The unretouched blastoff photo at left flashed by Associated Press wire and radiophoto to thousands of newspapers in the free world, was taken with a Birns & Sawyer 600 Omnitar lens on 35mm film from the "road block", a camera site a mile from the Mercury launch pad At the "press site", two miles from the pad, the AP had Big Bertha, a 1000mm Omnitar, firing away

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FROM BLASTOFF TO RECOVERY

story of "Friendship 7" in General Dynamics Film

AUSTRALIA — Down under crew films sequence in tracking station at Muchea. Loren Steadman, chief sound engineer, at left, assistant director Bill McClure at right.

HAWAII — Hawaiian eye in the sky was part of global chain of tracking stations. Eugene Keefer, left, was over-all producer.

MERCURY CONTROL TOWER — Film sequence shows orbital flight paths at Mercury Control Center which directs all Project Mercury Missions.

MARYLAND — Cameraman Merk Irwin sets up a converted Cine-Voice No. 73 with 1200' magazine at Goddard Space Flight Center.

TEXAS — Larry Newell in the tracking station at Corpus Christie.

CARIBBEAN — Cameraman Hal Reavely prepares to record the arrival of Astronaut John Glenn aboard aircraft carrier Randolph.

GENERAL DYNAMICS / ASTRONAUTICS FILMS HISTORICAL PROJECT MERCURY ORBIT FOR NASA

Friendship 7' an hour long, sound and color 16mm documentary on Astronaut John Glenn's orbital flight was produced for the National Aeronautics and Space Administration by the motion picture section of General Dynamics/Astronautics, San Diego, California. It was a mammoth undertaking, comparable on a lesser scale, to the planning for the mission itself.

"The film documents a moment in time," says Eugene C. Keefer, producer of the film and assistant director of communications at Astronautics. It covers the Project Mercury activities occurring around the world immediately preceding and during the flight."

Heart of the film are the scenes photographed at stations around the world as seen in the photographs above. More than 100 cameramen, soundmen, writers, editors and other production people helped make this exciting film.

BLASTOFF TO RECOVERY DOCUMENTED WITH BIRNS & SAWYER EQUIPMENT

It is not often that small companies can participate so intimately and totally in such a momentous undertaking as Project Mercury. Birns & Sawyer Cine Equipment Co. of Hollywood, was chosen prime contractor for the motion picture equipment because they have the nation's largest stocks of rental Auricons and Arriflexes readily available. The Birns & Sawyer staff is grateful for the part they were permitted to play in assembling the gear for the hard-working crews of General Dynamics/Astronautics.

The call-out of camera equipment was impressive. Some 31 cameras with 93 lenses and 13 special lenses, 62 film magazines, 12 light tripods, 19 heavy duty tripods, one blimp, one gyropod, several special heads and related special equipment. Of the 19 Auricons, 10 were Pro 600s and the balance were Cine-Voices adapted with Birns & Sawyer conversion blocks and 1200' Mitchell magazines. The next time you need to rent a camera — one, 31, or 100, call Birns & Sawyer.

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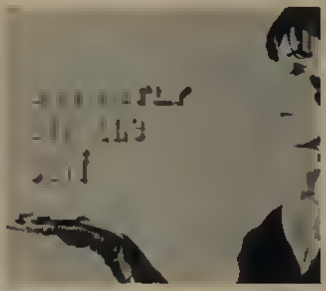

3-D Title Letters

Three dimensional title letters with a pressure-sensitive adhesive on the back have been placed on the market by S.O.S Photo Cine-Optics, Inc The letters are said to be easily applied on most any surface by simply peeling off a plastic backing, then pressing directly on the background surface to be photographed. Unusual titles and interesting shadows are achieved by placing directly on the roller drum of a titler, such as the S.O S. TG 1V, in relation to a 45 degree angle light source By using 3-D Title Letters on transparent surfaces and shooting right through, the film maker has an inexpensive art tool. When soiled, letters are readily cleaned by rubbing lightly with fine sandpaper. If desired, the letters can be colored with any type of paint S O.S. 3-D Title Letters range in price from $4.95 to $10 95 per set. Descriptive literature on request from S.O.S. at 602 W. 52nd St., New York 19, N Y

A-C Voltage Regulator

A transistorized AC voltage regulator that offers precise voltage for photographic uses such as studio lighting or darkroom chemical temperature control has been developed by Perkin Electronics Corp., El Segundo, Calif The fast response, 1-KVA unit provides a regulated AC output that is adjustable from 110 to 120 volts, with an accuracy of ±0.1%. Remote-sensing and automatically resetting thermal devices for overload protection make the unit, Model MTLR1000, ideally suited for remote location. The remote-sense feature can be used to regulate the voltage at a location where precise voltage is required, such as lighting arrays Complete data are available from manufacturer at 345 Kansas St., El Segundo, Calif

Omnitar Super-telephotos

Birns & Sawyer Cine Equipment Co., 6424 Santa Monica, Hollywood, announced at the SMPTE convention and exhibition their line of Omnitar Lenses are now available for the new Eastman Kodak Reflex Camera

Lenses may be purchased with either the "R" mount or with the Cine Special adapter and "SR" mount Photo above shows the 1000mm f/6.3 Omnitar mounted on a Kodak Reflex Camera

Gyro Head for Arri 16

A new gyro head of advanced design for the Arriflex-16 camera and the Arriflex 16 Tripod is announced by the Arriflex Corporation of America, 257 Park Ave. South, New York 10, N Y It has a full gyro in both the pan and tilt movements. The gyro is extremely quiet, is characterized by a fine, even movement, and is skillfully constructed with a minimal number of parts for maximum durability and

Continued on Page 282

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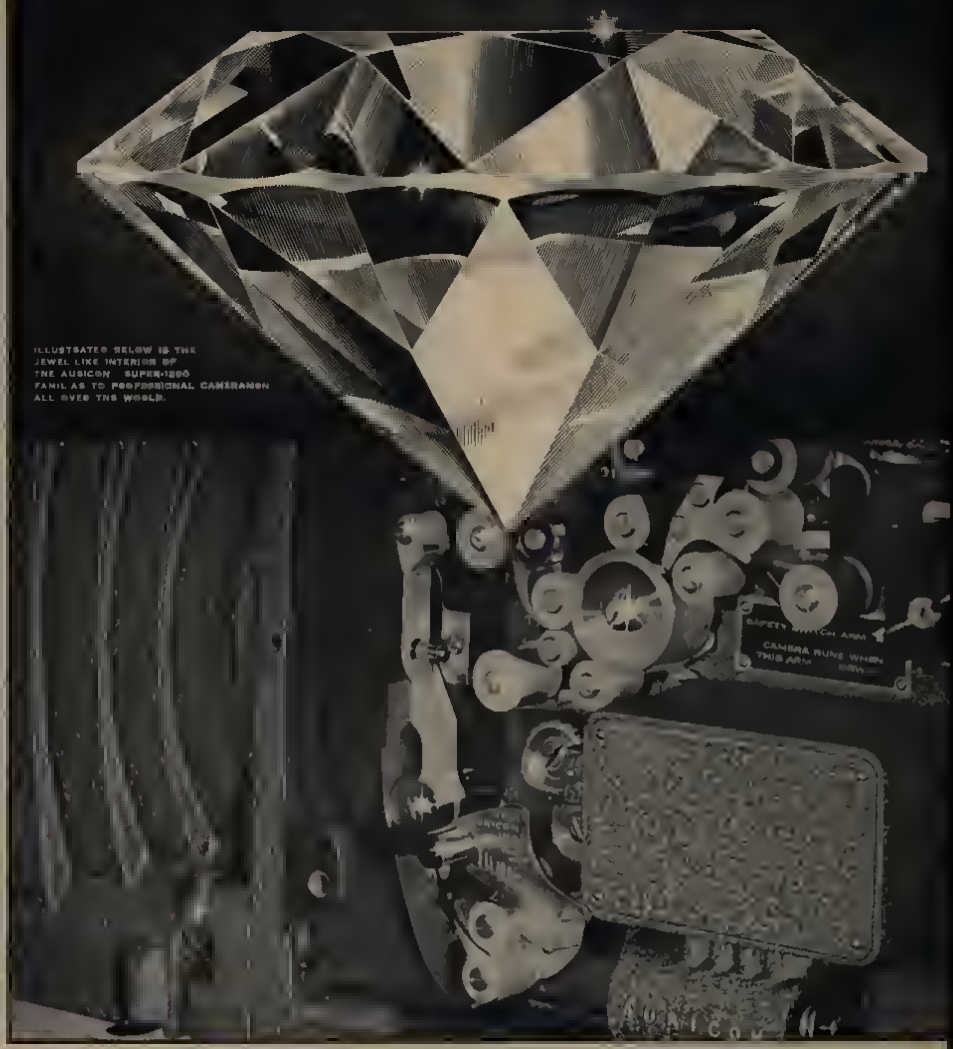
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WHAT'S NEW

Continued from Page 280

minimum maintenance requirements Either friction or gyro movements selectively, are available in the pan. The design is such as to protect the movement against damage due to sudden starts or sudden stops.

The new head may be interchanged with the regular Arriflex friction head on the Arriflex-16 Tripod It may also be used on the Arriflex 16 Shorty Tripod Weight of head only, 8 lbs ; weight of Arriflex-16 Tripod with Gyro Head· 18 lbs.; Will handle the Arriflex camera handily and larger and heavier cameras up to 22 lbs , net price is $650 00 from all franchised Arriflex dealers

Tape Recorder Brake

A new hold-back and brake system for professional tape recorders is announced by Magnasync Corporation, 5546 Satsuma Ave., North Hollywood Calif Assemblies are complete with torque motor, brake and reel hub, ready for mounting on tape transport panel High resistance motor, salient-pole torque motor is designed for continuous 24 hour operation. Solenoid operated brake consists of stainless steel drum and band with life-tested Dyeron band lining Exceptionally smooth braking action is adjustable to ¼", ½" and 1" tape handling for 10½" or 14" reels. Included with each integrated assembly is a unique NAB reel hub which centers and secures reels of varying width and bore size. Systems are currently being used on Air Traffic Control recorders for the Air Force. Price, approximately $100 00 depending on quantity Initial delivery from 6 to 10 weeks Literature available on request. ■

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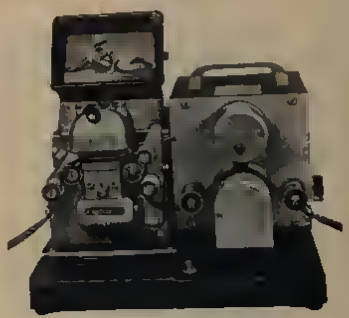
S O S. Ediola Pro 35 for 35mm	$295.00



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BEHIND THE CAMERAS

WHAT THE INDUSTRY'S CAMERAMEN ARE SHOOTING LAST MONTH

EXPLANATION FOLLOWS

NOTE: Asterisks following titles indicate television film productions.

EILTMORE STUDIOS — N.Y.

JACK PRIESTLY, "Naked City"* (Screen Gems).

BIOGRAPH STUDIOS — New York

GEORGE STOLTZEL, ASC, 'Car 54 Where Are You?"*,

COLUMBIA STUDIOS

DONALD GLOUNER, ASC, Commercials*

CHARLES LAWTON, ASC, Commercials*.

JAMES DROUGHT, Commercials*

GORDON AVIL, ASC, "Broken Lariat" (Faur Leaf Prod.; Eastman color) with James Philbrook and Nancy Kovack, Oscar Rudolph, director

WILLIAM WHITLEY, ASC, "3 Stooges in Orbit' with 3 Stooges and Edson Stroll Edward Bernds, director

SAM LEAVITT ASC, "Diamond Head" (P'Vision, Eastman color, shooting in Hawaii) with Charlton Heston and Yvette Mimieux Guy Green, director.

JACK MARTA, IRVING LIPPMAN, "Route 66"*

MAURY GERTSMAN, ASC, Commercials*

BURNETT GUFFEY, ASC, Commercial*,

CHARLES WELDORN, "Dennis the Menace"*, Commercials*

FRED GATELY, ASC, "Hazel"*

GERT ANDERSEN, ASC, "Donna Reed Shaw"*.

FRED YOUNG, "Lawrence of Arabia" (Super P'Vision, Eastman color, Horizon Pictures (GB), Columbia release, shooting in Spain) with Alec Guinness and Anthony Quinn David Lean, director

DESILU—Culver City

CHARLES STRAUMER, "The Untouchables"*.

LOTHROP WORTH, ASC, "The Real McCoys"*.

DESILU—Gower Studios

TED VOIGHTLANDER, "Ben Casey"*.

FILMWAYS — MGM

HAL MOHR, ASC, Commercials"*

THOMAS TUTWILER, ASC, Commercials*.

FILMWAYS—New York

MORRIS HARTZBAND, "The Defenders"* (CBS) Boris Sagal and Buzz Kulick, directors.

FOX STUDIOS—New York

ARTHUR ORNITZ, Twist Featurette (Vanguard Prods.)

GENERAL SERVICE STUDIOS

ROBERT MORENO, "Adventures of Ozzie & Harriet"*.

ROBERT HAGER, "Perry Mason"*

GOLDWYN STUDIOS

MEREDITH NICHOLSON, "The New Breed"*

TED MCCORD, ASC, "Two for the Seesaw" (Mirisch Robert Wise, Seven Arts Prod., P'Vision) with Robert Mitchum and Shirley MacLaine, Robert Wise, director

LIONEL LINDON, ASC, "The Manchurian Candidate" (M. C. Prods.) with Frank Sinatra and Laurence Harvey. John Frankenheimer, director

INDEPENDENT

EDMOND SECHAN Grand Duke and Mr. Pumm" (Oxford Prods., P'Vision Color shooting in Nice) with Glenn Ford and Hope Lange. David Swift, director

PAUL W PUCKETT, "Lustatia" Roll Mac Prod., color) with Paulann Hudson and Dave Morgan David McClellan director

FLOYD CROSBY, ASC, "Wounds of Hunger" (Task III Prod N.Y.; shooting in Mexico City, P'Vision) with Tony Anthony. Sol Swimmer, director

ROBERT BURKS, ASC, "The Birds" (Alfred Hitchcock Prods., shooting in Santa Rosa) with Rod Taylor and Jessica Tandy Alfred Hitchcock, producer director.

CARL KAYSER, "No Man is an Island" (Goldcoast Prod for U I release; shooting in the Philippine Is.) with Jeffrey Hunter, Richard Goldstone and John Monks, Jr., producer-directors.

KEYWEST STUDIOS

FRED WEST, ASC, (Family Films) Series of Religious pictures

METRO-GOLDWYN-MAYER

PAUL VOGEL, ASC, "Period of Adjustment" with Anthony Franciosa and Jane Fonda George Roy Hill, director

JAMES DROUGHT, Commercials*

GEOFFREY UNSWORTH, "The Main Attraction" (Seven Arts Prods.; C'Scope Eastman Color, shooting in London) with Pat Boone and Nancy Kwan. Daniel Petrie, director

MILTON KRASNER, ASC, "How the West Was Won" (MGM-Cinerama Prod., Cinerama and MetroColor, Episode 5) with John Wayne and Debbie Reynolds. Henry Hathaway, director

JAMES WILSON, "The Password is Courage" (Andrew & Virginia Stone Prod., shooting in England) with Dirk Bogarde and Nigel Stock. Andrew Stone, producer director

EUGEN SHUFTAN, "Captain Sinbad" (Technicalor, King Bros. Prod., shooting in Munich) with Guy Williams and Heidi Bruehl Byron Haskin, director

WILLIAM DANIELS, ASC, "Billy Rose's Jumbo" (Euterpe Prod; C'Scope & Metrocolor) with Doris Day and Stephen Boyd Chuck Walters, director.

ROBERT PITTACK, ASC, "Father of the Bride"*.

HARKNESS SMITH, "Dr. Kildare"*.

PARAMOUNT STUDIOS

ARTHUR ARLING, ASC, "My Six Loves" with Debbie Reynolds and Cliff Robertson. Gower Champion, director

LOYAL GRIGGS, ASC, "Girls! Girls! Girls!" (Hal Wallis Prod., color; shooting in Hawaii) with Elvis Presley and Stella Stevens Norman Taurog, director

W WALLACE KELLEY, ASC, "It's Only Money" (York Picts. Jerry Lewis Pictures Corp.) with Jerry Lewis and Joan O'Brien Frank Tashlin director.

FRANK PHILLIPS, "Have Gun Will Travel"*.

PARAMOUNT SUNSET STUDIOS

FLEET SOUTHCOTT, "Gunsmoke"*

LESTER SHORR, ASC, "Pete and Gladys"*

PRODUCERS STUDIOS

ARCHIE DALZELL, "The Tower of London" (Admiral Prods.) with Vincent Price and Michael Pate Roger Corman, director

REPUBLIC STUDIOS

CHARLES BURKE. The Law and Mr. Jones"*.

GEORGE DISKANT ASC, "Target the Corruptors"*,

REVUE STUDIOS

JOHN RUSSELL ASC, ELLIS THACKERY, ASC, JOHN WARREN ASC, "Alcoa Theatre"*

ELLIS THACKERY, ASC, JOHN WARREN ASC, "Tall Man"*.

JOHN WARREN, ASC, BENJAMIN KLINE, ASC, "Checkmate"*.

DALE DEVERMAN, ROBERT GOUGH, "Bachelor Father"*.

JOHN RUSSELL, ASC NEAL BECKNER, "Alfred Hitchcock Presents"*.

DALE DEVERMAN, "The Virginian"* (pilot).

RUSSELL METTY, ASC, "If a Man Answers" (Ross Hunter Prods., Eastman Color) with Sandra Dee and Bobby Darin. Henry Levin, director

CLIFFORD STINE, ASC, "The Ugly American" (Eastman Color) with Marlon Brando and Sandra Church George Englund, producer-director

RAY RENNAHAN, ASC, "Wells Fargo"*.

JOHN RUSSELL, ASC, "General Electric Theatre"*

RAY FLIN, "It's A Man's World"*

BENJAMIN KLINE, ASC, 'Thriller"*.

NICK MUSURACA, ASC, "Jack Benny Show"*

RUSSELL HARLAN, ASC, "To Kill A Mockingbird" (Pakula Mulligan Anthony Prods.) with Gregory Peck and Mark Badham Robert Mulligan, director.

JOSEPH LASHELLE, ASC, "A Child is Waiting" (Stanley Kramer Prods.) with Burt Lancaster and Judy Garland John Cassavetes, director

WILLIAM MARGULIES, ASC, '87 Precinct*.

JACK MACKENZIE, ASC, "Ichabod and Me"*.

WALTER STRENGE, ASC, "Wagon Train"*

FRED MANDL, ASC "Leave it to Beaver"*

TWENTIETH CENTURY-FOX

FRANK PLANER ASC, 'Something's Got to Give" (C'Scope & DeLuxe color) with Marilyn Monroe and Dean Martin George Cukor, director

WINTON HOCH, ASC, "Five Weeks in a Balloon" (C'Scope, DeLuxe color, Irwin Allen Prods.), with Red Buttons and Sir Cedric Hardwicke. Irwin Allen, producer director.

ARTHUR IBBETSON, "Nine Hours to Rama" (C'Scope; Deluxe color; Red Lion Prod., shooting in India) with Horst Buchholz and Jose Ferrer, Mark Robson, producer director

Continued on Page 322

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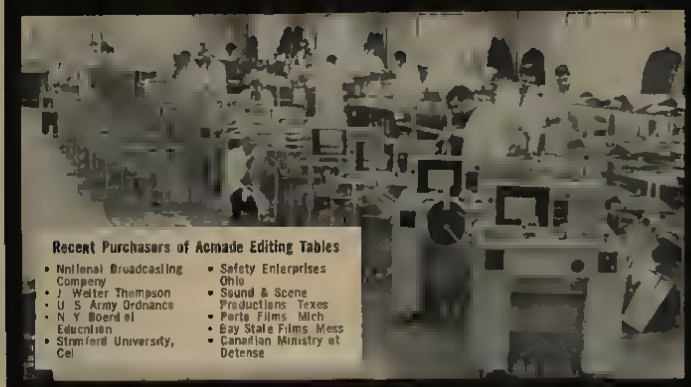

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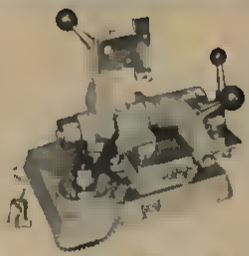
This moderately priced splicer incorporates new precision features which insure absolute accuracy and safety in splicing. Three models are available. Model 16-16mm, Model 35-35mm. Model 35-16 combination 35mm and 16mm



1. The combination 35mm-16mm Model features retract table 35mm and 16mm pins. This permits center placement of the 16mm pins for A and B roll splicing.

4. Specially designed right-hand pressure block permits easy end accurate back scraping on all models.

5. Tempered steel springs provide perfect pressure positioning film firmly during scraping and splicing processes.

2. Stainless steel blocks are precision fitted with Tungsten Carbide inserts for cutting. Cutting edges will remain sharp and last forever.

3. Attached scraper adjustable for depth — fitting jig incorporated on splicer base.

6. Thermostatically controlled heater maintains constant 100° temperature.

Model 16 — $299

Model 35 — $299

Model 35-16 — $399

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Acmade Foot-Operated Splicer with Tungsten Tipped Blades

Combination 16mm-35mm Model

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This splicer is constructed, as is usual with ACMADE products of the finest materials and workmanship. All castings are of the best quality and the top body and cutter arms are seasoned to prevent distortion after machining. The machining is carried out to limits of ± .0005" in order that the cutter blades shall close in a dead parallel manner. The cutter blades are made from stainless steel with Tungsten Carbide inserts, and afterwards ground lapped and polished to a limit of ± .0002" thickness and the cutting edges relieved by 1°. The Tungsten Carbide inserts will have indefinite life and will not require sharpening as with other types. A heater unit is installed in the top body of the machine. The top light in a well glass fitting is attached to the body of the machine and also an inspection light in the waste bin together with cement bottle and brush. A scraper block is supplied and also a scraper block setting jig and support shell rubber-covered. The whole machine is finished in first quality grey hammer and all metal parts other than cutter blades are hard flash chromed.

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PRODUCTION CREW worked a half day placing lights and generators and lining up the camera for a series of night shots that were to be made here That night, fog suddenly rolled in after the second take

VAST INTERIOR of Crocker Bank presented lighting problems because of huge windows, light walls Contrary to conditions usually encountered light level was higher than in outdoor areas seen through windows

'EXPERIMENT IN TERROR' –

. . . a classic in low-key cinematography.

"EXPERIMENT IN TERROR" is the kind of crime melodrama that depends substantially on the photography to give it special visual impact. It is a classic in low-key, suspenseful cinematography—a prime example of what imaginative lighting and carefully designed camera angles can do to wring the last ounce of suspense from a story that achieves stark terror in the opening shot and maintains it throughout the picture.

Produced and directed by Blake Edwards for Columbia Pictures, the photography, in black-and-white and 185-to-1 format, was directed by Philip Lathrop, ASC. "Experiment In Terror" is pure chase. Kelly Sherwood, a bank teller, played by Miss Lee Remick, is chosen by an unseen psychopathic killer as his accomplice in a $100,000 bank robbery. Driving home from work after dark, Kelly parks her car in the garage of her home, the overhead door of the garage closing after her. Inside in the darkness, she is seized by the criminal. Stifling her outcries with one hand clasped over her mouth, he details his plans carefully and threatens her and her younger sister with death if she refuses or betrays him. After he leaves, Kelly immediately contacts the FBI, and the film becomes an exciting hunt for a faceless man whose powerful weapon is anonymity. Glenn Ford plays John Ripley, the FBI agent who works closely with Kelly to thwart the criminal's plans.

A substantial amount of the action was photographed on location in and near San Francisco. Locations here included streets, a hill residential area, a public swimming pool, the Crocker Bank, the Roaring Twenties night club, and Candlestick ballpark.

SHOTS MADE from helicopter of exciting chase through streets, and of criminal's capture in ballpark are among highlights of Experiment In Terror Here copter is set up on special platform on sound stage for making a process shot

TENSE, EXCITING chase scenes for 'Experiment in Terror' were staged in San Francisco's Roaring Twenties night club. Camera is being lined up for shot of bank teller Kelly seeking a killer among gay revelers.

One of the most striking exterior night shots ever seen in a motion picture was imaginatively illuminated and photographed by Lathrop on a hilly location overlooking San Francisco.

"The effect we aimed for," said Lathrop, "was to make the scene look completely natural rather than one that was purposely lit for photography."

Although preparation for photographing the scene began early one afternoon, the ultimate shot was night-for-night—as were all night shots in the picture—and photographed around 9 p.m. It was a long-shot view of the hilly residential area in which Kelly resides with her teen-age sister. Unlike so many motion picture scenes of this type that are simply flooded with flat lighting, Lathrop spotted the lighting at carefully chosen points in the scene and blended it into the shadows. What resulted is a genuine aspect of naturalness and at the same time great depth is achieved in the overall scene—a scene that is highly important in establishing locale of the home and its surroundings early in the picture.

Early in the afternoon preceding the shooting, three generators were moved into the area and strategically placed to supply power for the three planes of lighting which were planned for the location. Big Brute arcs were mainly used, augmented by smaller lighting units concealed in various places to throw effect lighting on one or two homes, a garage, shrubbery, etc., to give the overall scene a most realistic nighttime appearance. According to Lathrop, the effective photographic illumination ranged upward from 50 foot candles, depending on location of the camera.

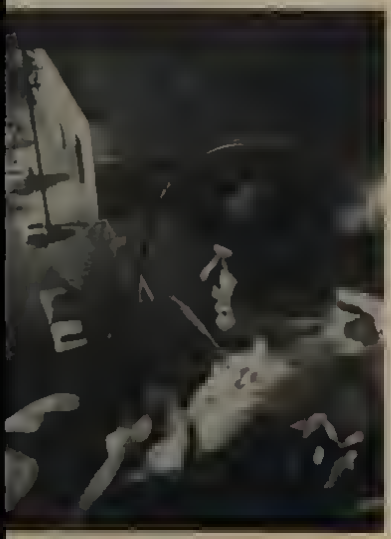
Ironically, shortly after shooting began on this location, heavy fog suddenly rolled in from the bay and enveloped the area, closing down operations after only a few takes.

The choice of the Crocker Bank in San Francisco as the setting for many scenes in the picture posed a great many problems, mainly because of its vast size, its huge windows and the light color of the interior walls.

"This was probably the first time I ever worked in an interior where I had less light coming through the windows than I had inside the building," Lathrop com-

Continued on Page 318

VIEW FROM cameraman's position behind helicopter pilot, showing background plate projected on process screen as photographed in the camera setup pictured at left



PHILIP LATHROP, ASC (right), who directed the photography of 'Experiment In Terror,' watches action staged in Roaring Twenties night club as camera operator Richard Kline makes effect shot with hand held Arriflex camera

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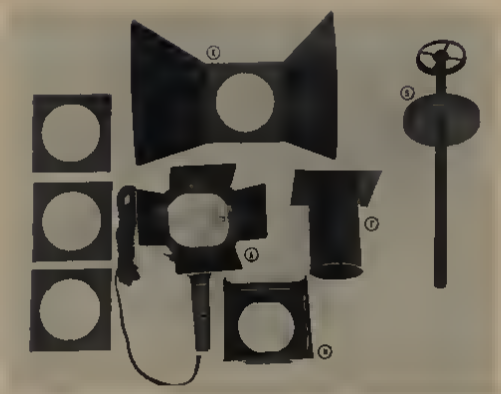
THE SUN

MERITS OF NEW Sylvania Sun Gun are discussed by William Widmayer (right), head of camera department, Columbia Studio, and cinematographer Joseph Biroc, ASC, following series of tests given lamp at studio. Lamp pictured is original Sun Gun Movie Lite, less powerful and sans accessories of the newer Professional model



SUN GUN PROFESIONAL and accessories. Lamp is shown at A with 4-leaf barndoor with which it comes equipped. Other items are B—daylight filter; C—3200° K filter; D—portrait lens, E—large barndoors, F—snoot; G—optical 'sniper' snoot, H—accessory holder

30-VOLT BATTERY POWERED Sun Gun and power source—a 17½ pound unit designed for newsreel, documentary and travelogue cinematographers

THE METEORIC RISE of the Sylvania Sun Gun photo light from merely a revolutionary new light source for amateur movie makers to the hottest item of lighting equipment on Hollywood sound stages today was appropriately climaxed last month when the Academy of Motion Picture Arts and Sciences honored the new lamp with its Class II Technical Achievement Award.

The Sun Gun's emergence from its original amateur status to that of professional began rather incidentally when William Widmayer, head of the camera department at Columbia Studio, chanced to see one of the early Sun Guns in a Hollywood camera store. He obtained three Sun Gun Movie Lights, as the initial model was named, for the purpose of testing the units's potentials as a compact, portable light source for filming location interiors and for use in certain situations on the sound stage. Unbeknown to Widmayer or Sylvania, these tests were to mark a turning point in the Sun Gun's future and alter drastically some phases of set lighting procedure.

The initial tests at Columbia were photographed by Arthur Arling, ASC. News of the excitement generated by Columbia's tests attracted the attention of other studios which also tested the lamp under a wide range of photographic conditions. William Daniels, ASC, lit an entire interior set with Sun Gun Movie Lights on an MGM sound stage and achieved impressive photographic results.

Meanwhile, Sylvania engineers had heard of Hollywood's interest in the Sun Gun and flew repre-

GUN PHOTO LIGHT

This tiny package of lighting dynamite faund immediate acceptance in Hollywood studios and has been honored with an Academy award.

By FRED FOSTER

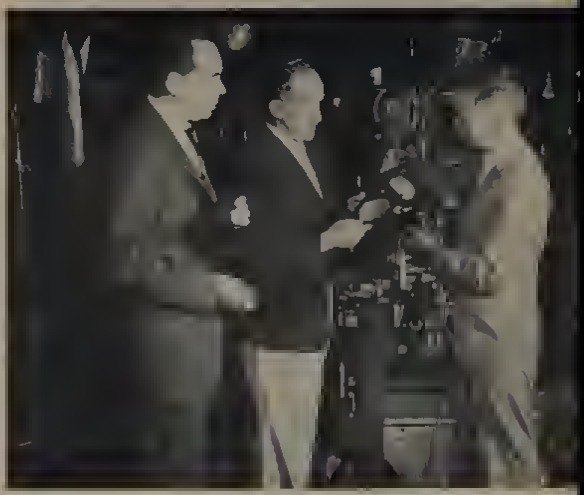
sentatives to the West Coast to see what all the excitement was about. There, on Hollywood sound stages, they discovered a totally unexpected use for their latest lighting product. Meeting with Widmayer at Columbia Studio, they viewed the tests the studio had made, listened to suggestions for improving the Sun Gun for professional use, then returned to the factory to revise it.

Months later, rather quietly the Sylvania engineers returned to Hollywood with a new version of the Sun Gun—a slightly larger and more powerful unit which was now called the Sun Gun Professional. This was a three-pound, 1,000-watt lighting unit capable of delivering the same volume of photographic illumination as a 5,000-watt flood light with the same beam angle.

Key component of the Sun Gun is its tiny, powerful Halogen lamp—also known as a quartz-iodine lamp. The principle of the quartz-iodine lamp is fairly simple; it consists of a tubular quartz envelope about 3 inches in length and about ½ inch in diameter, pinch-sealed at both ends. This contains a tungsten filament giving a very high light output —thus the need for the quartz tube or envelope to withstand the high working temperature which would melt ordinary glass.

At the extreme working temperature, the tungsten filament would soon evaporate, to be deposited as a dark coating on the inside surface of the tube—similar to that seen in photoflood lamps after extensive use. The presence of iodine salts, presumably ionized when current is switched on, exerts a scavenging action which retards evaporation of the filament and consequently postpones fracture and darkening of the tube. Argon gas is said also to be a component, which presumably influences color temperature.[1]

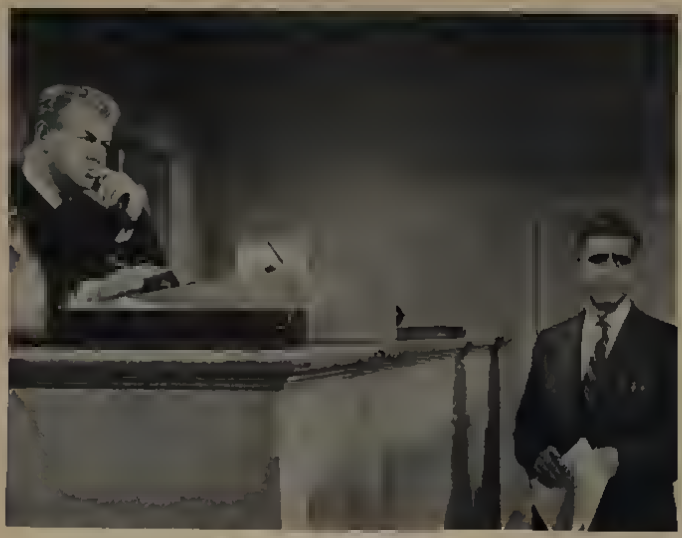
Continued on Page 314



DIRECTOR OF PHOTOGRAPHY Lionel Linden, ASC (center), is briefed on merits of the Sun Gun Professional by Sylvania's Russell Barden (right) and John Zweid, Sylvania engineer. Linden subsequently used lamps to shoot location scenes for "The Manchurian Candidate"

DIFFUSING FILTER for Sun Gun Professional is tested by Hollywood still photographer Ted Allan (right) with assist from Russell Barden. Heat and scorch resistant filter is useful in closeup photography

FUNCTION OF the Daylight and 3200° K filters are explained to Director of Photography Philip Tannura, ASC (left) who earlier had used Sun Gun Movie Lights in novel photographic set-up for scenes for "Shannon," TV film series produced by Screen Gems of Columbia Studio



THE FILM MAY BE first exhibited to the judge and opposing counsel to eliminate all objections that might interrupt the showing of the film to the jury

CINEMATOGRAPHY IN LEGAL EVIDENCE*

Increasing use is being made of motion pictures to provide or support evidence in both civil and criminal cases. Here are legal facts to guide both the litigant and the cinematographer he employs to produce such films.

MOTION PICTURES, when relevant and properly authenticated, are admissible in evidence to help establish the scenes or events they depict. They are competent evidence, not subject to the objection that they are heresay or that their admission violates the best evidence rule. Their admission is a matter within the discretion of the trial court. He may decide that they will confuse, rather than aid, the jury, or that they are prejudicial to an extent which outweighs their usefulness in proving an issue. On the other hand, an improper exercise of this discretion to exclude such evidence may be ground for reversal.

Motion pictures, like any other evidence, must be relevant to be admissible in evidence; they must tend to prove or disprove some issue in the case. Where a film contains irrelevant and prejudicial matter, the trial court is generally under no duty to separate the good from the bad, and in its discretion may exclude the entire film.

A motion picture is not admissible in evidence unless a witness identifies the persons, objects or places pictured and testifies that the film fairly and accurately depicts a scene or events that he personally observed. This extrinsic evidence is the indispensable authenticating element necessary for the admission of motion picture films. In addition, it is customary to show the circumstances of the taking, developing and projection of the films as part of the authentication. In this connection, there may be evidence of the skill and experience of the photographer; the position of the camera; the type, adjustment (i.e., lens settings, etc.) and functioning of the equipment used; the lighting and weather conditions in which the pictures were taken; the custody of the film; the manner of development and printing; and the equipment used and conditions of its exhibition to the jury.

The extent of the authentication required in any given case varies with the form and subject matter of the films to be shown, the purpose behind their introduction, and the willingness of the trial judge to exercise his discretion to admit such evidence. Detailed testimony of the matters outlined above is not always necessary, but is often presented nevertheless in order to avoid quibbling and to impress the jury with the importance and accuracy of the motion picture evidence.

It has been said that the preliminary proof required for the authentication of motion pictures is similar to that required for still photographs. On the other hand, it has been contended that the possibilities of distortion, misrepresentation and prejudice are greater in the case of motion pictures, through control of camera speeds and editing, and that therefore more detailed authentication

Continued on Page 312

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WIDE SCREEN PRODUCTION

UNTIL RECENTLY, the publication of technical literature on professional cinematography was devoted largely to information relating to one type of camera and one group of lenses. With the expansion of the screen in the theatre, this situation has changed drastically. In order to provide maximum image quality for large screen motion picture presentation, it has been necessary to develop and employ so called wide-screen processes in theatrical film production.

Space does not permit setting down here in detail information relating to all the different systems devised during the several years of technical evolution which has brought us the present wide screen systems. This report, therefore, will be concerned with the six systems of wide-screen film production which can be regarded as *established* and worthwhile describing.

Without going into detail at this point, and before outlining the present wide screen systems, it should be pointed out that the "actual" camera aperture dimensions are no longer important in wide screen production. The "composition aspect ratio" and the intended release form as decided by management are the dominant factors. They are expressed in ground glass and finder markings and have more importance to the cinematographer today than just the skillful maintaining of head space when we were dealing only with the Academy aperture of 1.33:1 aspect ratio and a release print of equal proportions.

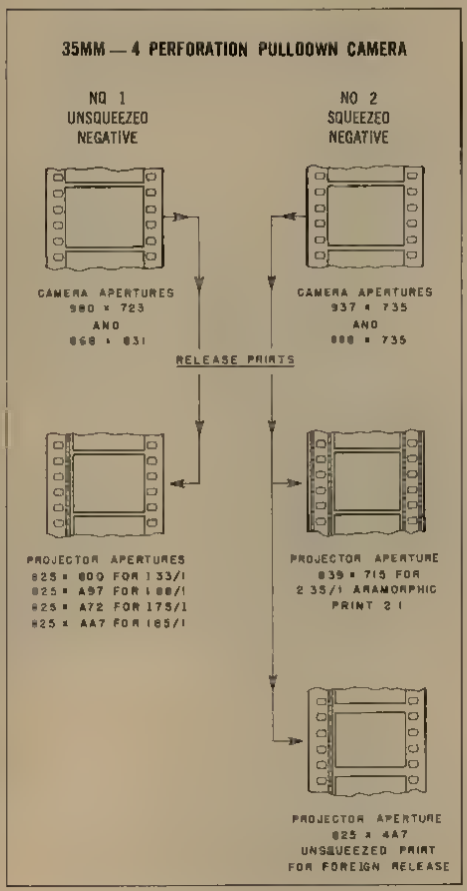

35MM — 4 PERFORATION PULLDOWN CAMERA
NO 1 UNSQUEEZED NEGATIVE
NO 2 SQUEEZED NEGATIVE
CAMERA APERTURES .980 x .723 AND .868 x .631
CAMERA APERTURES .937 x .735 AND .868 x .735
RELEASE PRINTS
PROJECTOR APERTURES .825 x .600 FOR 1.33/1 .825 x .497 FOR 1.66/1 .825 x .472 FOR 1.75/1 .825 x .447 FOR 1.85/1
PROJECTOR APERTURE .839 x .715 FOR 2.35/1 ARAMORPHIC PRINT 2:1
PROJECTOR APERTURE .825 x .447 UNSQUEEZED PRINT FOR FOREIGN RELEASE

Fig 1

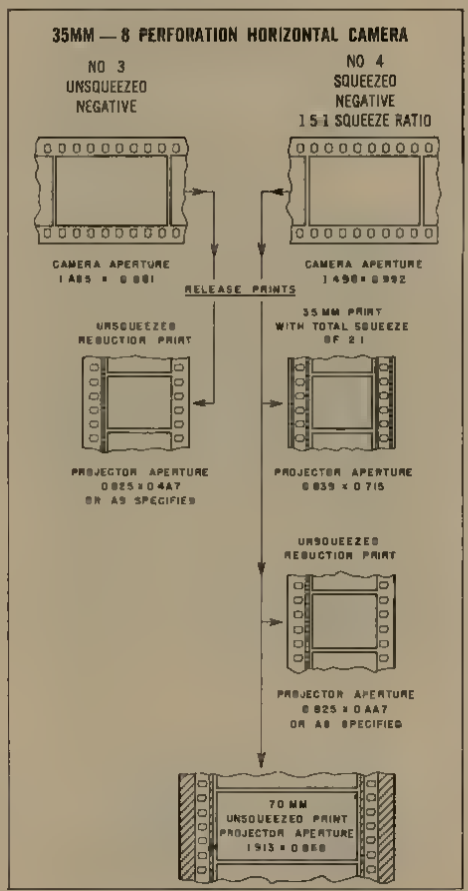

35MM — 8 PERFORATION HORIZONTAL CAMERA
NO 3 UNSQUEEZED NEGATIVE
NO 4 SQUEEZED NEGATIVE 1.5:1 SQUEEZE RATIO
CAMERA APERTURE 1.485 x .980
CAMERA APERTURE 1.490 x .992
RELEASE PRINTS
UNSQUEEZED REDUCTION PRINT
35 MM PRINT WITH TOTAL SQUEEZE OF 2:1
PROJECTOR APERTURE .825 x .447 OR AS SPECIFIED
PROJECTOR APERTURE .839 x .715
UNSQUEEZED REDUCTION PRINT
PROJECTOR APERTURE .825 x .447 OR AS SPECIFIED
70 MM UNSQUEEZED PRINT PROJECTOR APERTURE 1.913 x .868

Fig 2

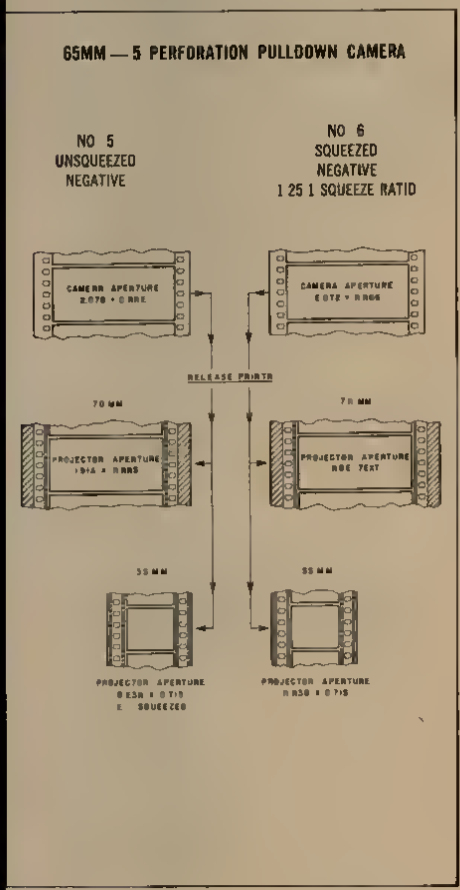
1960

SYSTEMS

By WALTER BEYER
Head of Engineering, Universal International Pictures

The six systems for wide screen feature film production as presently used throughout Hollywood are:

1. 35mm camera, 4-perforation pulldown, non-squeezed wide screen photography.
2. 35mm camera, 4-perforation pulldown, squeezed photography (CinemaScope and Panavision)
3. 35mm camera, horizontal, 8 perforation pulldown, non squeezed photography (VistaVision)
4. 35mm camera, horizontal, 8-perforation pulldown, squeezed photography (Technirama).
5. 65mm camera, 5-perforation pulldown, non-squeezed photography (Todd-AO and Panavision 70).



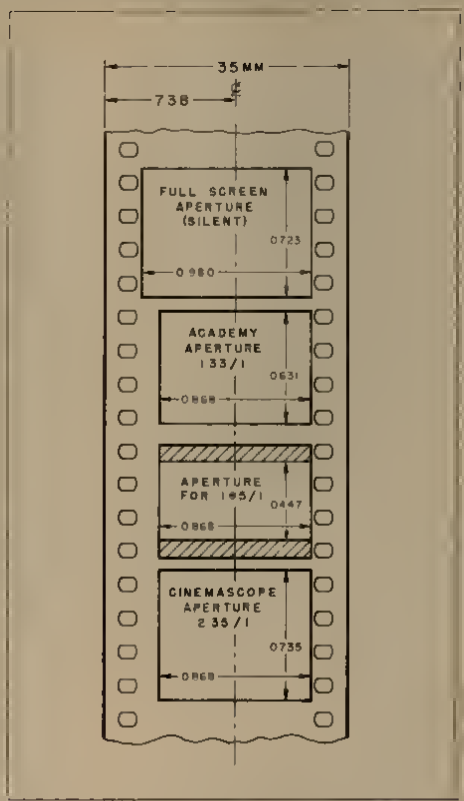


FIG 4—Comparative picture areas and dimensions of the various camera apertures used with 35mm negative

6 65mm camera, 5-perforation pulldown, squeezed photography (Ultra Panavision and MGM Camera 65).

The above six methods are presently used by various major studios and independent producers. Special multi-negative systems, such as Cinerama and Cinemiracle, will be described separately.

The diagrams or "flow charts" at left illustrate the camera and projector apertures employed for the various wide screen systems. Diagrams of the film sections at the top of each chart represent the type of negative and the camera aperture dimensions of the respective systems. Below the words "release prints" the picture areas and aperture dimensions of the possible formats for theatrical release prints are shown. Data for release prints in 16mm are not included.

Wide Screen System No. 1:

Fig 1 describes the 35mm camera, 4-perforation pull down, used for non-squeezed wide screen photography listed under No 1, and for squeezed photography listed under No. 2.

Cameras for non-anamorphic wide screen photography are generally equipped with the Academy aperture of

Continued on Page 304

Logistics

By PAUL METZLER

START OF AN ACHIEVEMENT—Astronaut John Glenn enters space capsule to begin successful world girdling flight. This historic scene appears in the motion picture, "Friendship 7", hour-long documentary of the flight and its preparation produced by General Dynamics/Astronautics of San Diego, California

FILMING OF pre launch activities in blockhouse at Cape Canaveral are discussed by cinematographer-editor Bruce Herschensohn (left) and producer of film, Eugene Keefer

When astronaut John Glenn was lifted into his history-making orbital space flight by a thundering Atlas rocket in the bright sunny morning of February 19, motion picture cameras recorded on 16mm color film the successful and historic event from the exciting moment of the blastoff to Glenn's emergence from the space capsule on the deck of a carrier in the Atlantic.

Within the capsule itself, two Milliken cameras photographed the instrument panel and Glenn's facial reactions during course of the flight. On the ground at the press sites—one a mile from the Mercury launch pad and the other two miles away—Associated Press photographers had trained their cameras with 600mm and 1000mm Birns & Sawyer Omnitar super-telephoto lenses on the mighty white rocket to catch the moment of blastoff.

And at every Mercury tracking station around the world other motion picture cameras had been set up weeks earlier to record incidents related to the flight. The results of this unprecedented filming project are to be seen in a recently-released motion picture titled "Friendship 7," a dramatic documentation of Col. Glenn's successful accomplishment. The hour-long sound-and-color film was produced for the National Aeronautics and Space Administration by the Motion Picture Section of General Dynamics/Astronautics (GD/A), San Diego, and covers Project Mercury activities occuring around the world immediately preceding and during the flight.

Supplying the cameras and lenses for GD/A's mammoth photographic undertaking was the rental department of Birns & Sawyer Cine Equipment, Hollywood.

The planning on this documentary film began early in 1961 when it became apparent that the United States would have the ability to put a man in space sometime during the year and thus match Russia's space effort. Three years earlier, General Dynamics/Astronautics had come to Birns & Sawyer for equipment and guidance for its first big filming project—the thirty-minute color film "On Target" which documented the success of the Atlas ICBM and included footage shot in various parts of Central and South America. The motion picture has since won a number of awards in industrial film competitions, and it was Birns & Sawyer that furnished the fledgling film department of GD/A with

Of A Global Filming Project

For the motion picture "Friendship 7", cameras, lenses and tape recorders were dispersed around the world to record in pictures and sound the activities incidental to John Glenn's historic space flight.

BATTERIES OF film and TV cameras were assembled on deck of aircraft carrier operating in Atlantic near site of capsule recovery

CINEMATOGRAPHER Charles DeMund recorded pre flight activities aboard the aircraft carrier Randolph using a tripod-mounted 16mm Arriflex camera.

PRIOR TO FLIGHT, cameramen photographed sequences for "Friendship 7" at tracking sites and in major cities around the world. Here Bob Montague Sims atmosphere shots at the Sultan Mesque, Johore Bahru, Malaya.

four Magnasync tape recorders and four Auricon cameras for the project. The success of this film production was a terrific stimulus for the makers who went on to become one of the dominant industrial film production units in America.

Thus, when in 1961, it became apparent that something really big was in the wind for GD/A, the company alerted Birns & Sawyer to the fact it might require a large number of Arriflex and Auricon cameras sometime later in the year. It was then that B&S increased its stock of cameras to the point where it could boast the largest number of Auricon and Arriflex cameras on hand in the country.

When the scientists at Cape Canaveral were ready, when the smiling freckle-faced Marine flier was ready, and when the cameramen of GD/A were ready, their extra photo equipment needs were ready, too. Birns & Sawyer had fitted some 19 Auricon and 12 Arriflex 16mm cameras with 106 lenses, tested and conditioned them, and had prepared them ready for delivery to the various Mercury tracking stations around the world.

To assist in this operation, Hal Reaveley and Charles DeMunn of GD/A joined the B&S staff working in the company's Cabuenga Tower Studio to assemble and pack the gear, which also included 150 Sylvania Sun Guns and 23 Roberts recorders. Almost a ton of foam rubber packing material and 108 Halliburton carrying cases were used in this

Continued on Page 310

GDA RECEPTIONIST Pat Wardell checks clocks which show time at prime tracking stations along the Mercury system network which followed John Glenn in orbit. Here cameramen were stationed and photographed incidents relating to tracking activities

PROS AND CONS OF 16MM COLOR NEGATIVE

Aside from its lower initial cost, there are other fatcors that must be considered by those contemplating use of 16mm color negative.

By DARRIN SCOT

When 35mm Eastman color negative was introduced several years ago it revolutionized tbe production of professional theatrical films in color by eliminating costly, cumbersome 2-strip and 3-strip filming processes with their correspondingly intricate and expensive laboratory requirements. It simplified the overall technology of color cinematography down to the point where it was only slightly more complex and costly than black-and-white filming. The result was a tremendous boom in the production of theatrical pictures in color, the feasibility (for the first time) of "low budget" color features, and the paving of the technical way toward extensive use of anamorphic and 70mm methods of feature production in color.

The next logical question was: "Why not a 16mm version of the Eastman color negative?" In cautious response Eastman released (on special order only) a 16mm color negative material slit from the same sheet stock as their old type 35mm (Type 5250) color negative. Because the grain inherent in tbe film was magnified in 16mm projection, it was never widely used, except in Japan where for a long time there was a dearth of facilities needed to process 16mm color positive emulsions such as Ektachrome.

With the announcement last fall of the new (Type 5251) 35mm Eastman color negative characterized by faster speed (ASA 50) and finer grain, interest in a 16mm version of the color negative again soared. Early in March, Eastman provided laboratories with sample rolls of the new 16mm negative for making exposure and processing tests. The most comprehensive series of tests of the film has just been completed by General Film Laboratories in Hollywood, and this writer was privileged to review the results under carefully controlled projection conditions. As might be expected, the results were extremely revealing and should answer many important questions posed by producers and technicians in 16mm film production.

Cost A Major Consideration

Before evaluating them in detail, however, let us analyze some of the diverse factors involved in the possible wide-scale utilization of 16mm color negative. The first major consideration is that of cost. Theoretically, the most economical method of production utilizes a negative material exposed in the camera, from which release prints are made directly. The initial economy prevails because negative stock is considerably less expensive than reversal positive original stock. The same economy follows through in release printing.

From the quality standpoint it would also seem that the best definition and color rendition would be achieved by making prints directly from a color negative. Any question of "ultimate quality," however, must take into consideration the matter of quantity release—and it also inevitably involves certain comparisons between 16mm and 35mm.

Even when exposed under the same conditions, 16mm negative cannot provide the same quality as 35mm negative—assuming that both will be blown up to the same screen size in projection. Both 16mm and 35mm Eastman Color negatives are cut from the same basic color sensitized material. Therefore the grain size is the same in each, but the ratio of grain-to-picture is highly in favor of 35mm simply because the picture area is six times larger than in 16mm. Given the same professional exposure and processing, the 35mm color contact print will be notably better than the 16mm color contact print made from a corresponding negative of the same material. Similarly, a 16mm color print reduced from a 35mm color negative will be better than a 16mm color print made directly from a 16mm color negative.

Grain-to-picture Area Ratio

Because of the difference in grain-to-picture area ratio, 16mm negative cannot go through intermediate printing stages as satisfactorily as 35mm. In each case there is some unavoidable loss in quality at each printing stage. But in 35mm the quality will

Continued on Page 302

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16MM COLOR NEGATIVE

Continued from Page 300

hold up through more printing generations than in 16mm. Thus, a 35mm color print which resulted from a camera-negative master-positive dupe-negative process will hold screen quality much more successfully than a 16mm print starting with 16mm negative and made through the same series of stages.

Also to be considered is the extra care needed in working with a negative material to avoid damage in handling. Any negative material should, of course, be handled as little as possible. In 35mm work, the camera negative is normally processed by the lab and stays in the lab vault—with daily prints being delivered to the editor for cutting and recording use. The negative is never taken out of the vaults except for the printing of opticals and the eventual conforming to the edited workprint.

The same procedure should be followed with 16mm originals—negative or positive. But there is a general tendency to excessively handle 16mm originals in positive form—running them through a Moviola or viewer to pick print takes, check color tone, etc. If this same casual treatment were applied to a negative original the resultant scratches and handling abrasions would be much more noticeable. Dirt on the negative, for example, shows up on prints as distracting white "snow".

Another highly important consideration is that of safety in the duplication of quantity print orders. In printing directly from 16mm Ektachrome original to Kodachrome duplicating stocks—under professional lab conditions—the original film can produce hundreds of prints without apparent deterioration in the physical condition of the edited originals. However, since the advent of 16mm color inter-negative, most 16mm color print orders of 10 or more are made through internegative-positive, rather than reversal printing. This provides an important margin of safety since, should anything happen to the internegative, the original can simply be taken out of the vault and a new internegative made. In using 16mm negative, even in black-and-white, runs have been made of fifty or more prints from the edited camera negative. But to insure safe duplication in quantity runs, producers and laboratories prefer to go through the extra intermediate stages involving master positive and dupe negative. The same safety factor should be applied to printing from a 16mm color negative.

This being the case, the economy arising out of the difference in cost of original materials would be cancelled out by the additional generation that would be needed. Also, 16mm color negative involves color correction in printing, which is rarely required in 16mm Ektachrome work. Color correction calls for added skills and added hours—which means added costs.

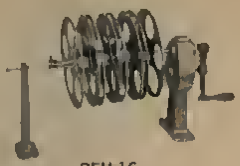
The proof of any pudding, of course, is in the tasting—and it was with this in mind that General Film Laboratories enlisted the aid of three independent production companies in the Hollywood area to film matched tests of similar subject matter using the new Eastman color negative and alternative materials. The camera stocks used were:

1) 16mm Ektachrome (Type 5255)
2) 16mm Eastman color negative (Type 7251)
3) 35mm Eastman color negative (Type 5251)

After processing, the three films were printed by the several possible methods. First, a series of prints was made by direct contact printing from the processed originals:

1) 16mm Kodachrome print (5269) from 16mm Ektachrome (7255)
2) 16mm color positive print (7385) from 16mm color negative (7251).
3) 35mm color positive print (5385) from 35mm color negative (5251).

The 35mm color positive print was most pleasing in terms of color rendition, sharpness, highlights and shadow detail. The 16mm color positive print from the 16mm Eastman color negative had excellent overall quality—good color rendition, clean highlights, crisp sharpness and good rendition of shadow detail. By comparison with the 35mm print it did, of course, show some increased graininess and loss of definition, but not to any objectionable degree. The color reversal print also showed good color rendition—although more pastel than in the print from the 16mm negative—and acceptable definition. In comparing prints made from the 16mm Ektachrome original and from the 16mm Eastman color negative, this observer much preferred the latter because of its crisp, sparkling quality—finding the slight increase in



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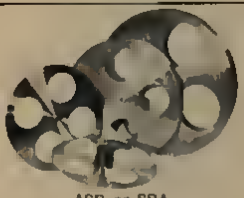

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graininess not objectionable.

Interesting as the above series of tests proved to be, of much greater significance to the commercial producer was the series that immediately followed. Since, as has been pointed out above, there is a definite limitation to the number of release prints that can or should be made from the edited original film — particularly negative material—the important question involved finding out what the print quality would be in following the accepted, practical stages of quantity duplication. So the next set of tests included the following 16mm color prints:

1. 16mm reduction print direct from 35mm color negative (5251)
2. 16mm contact print from 16mm color dupe negative intermediate on 35/32mm stock (5253) which had been reduced from a 35mm color master-positive intermediate (5253), made from the 35mm camera negative (5251)
3. 16mm contact print from a 16mm color dupe negative intermediate (5253) which had been made from a 16mm color master positive intermediate (5253), made from the 16mm color negative (7251).
4. 16mm contact print from a 16mm color internegative (7270) which had been printed from 16mm Ektachrome (7255)

The first two methods described above are already the accepted procedures for producing 16mm color prints from 35mm negative. The fourth is also the presently-accepted method for making 16mm color positive release prints, starting from an Ektachrome original. The third method would be the normal way to provide intermediates, in order to make it unnecessary to use the valuable 16mm color negative in quantity release printing.

In a direct comparison of all four methods, the best screen quality clearly resulted from reducing the 16mm print directly from the 35mm camera negative (#1 above). Following closely was the 16mm contact print from reduction 35/32mm dupe negative (#2 above).

Contrast was picked up by both the dupe negative-positive print method (#3 above) and the internegative-positive print method (#4 above), perhaps somewhat more in the former. There was also an appreciable and objectionable increase in graininess in the print made by the 16mm negative—16mm positive—16mm dupe negative method—although color rendition, clean highlights and shadow detail held up surprisingly well. The print made through the internegative method was comparatively free of grain and had better definition.

On the basis of the tests observed, this writer would hazard the following conclusions:

1. The best 16mm color print will continue to be the one reduced from the 35mm color negative.
2. The practical choice for 16mm multiple release printing in color from 16mm originals will be the positive print from 16mm color internegative, made from an Ektachrome original.
3. The 16mm color positive print made direct from 16mm color negative (7251) is a high quality, commercially acceptable product—but with the usual practical limitation on the number of prints which can be made before negative deterioration.
4. The 16mm color positive print from the 16mm color negative—master positive—dupe negative method is not commercially acceptable due to excessive build-up of contrast and grain.

On the basis of the technical factors which prevail today, the 16mm color negative exposed in the camera has essentially the same advantages and disadvantages as does the 16mm black-and-white camera negative used to make 16mm black-and-white release prints, and it is significant that usage in the field has indicated that 16mm reversal films are preferred as originals over existing 16mm black-and-white camera negative films.

As a general conclusion it is safe to predict, then, that the producer of 16mm color films who demands the ultimate in quality, and has the necessary budget, will shoot 35mm color negative for reduction. The producer who has a smaller budget for production, and a sizeable print order, will shoot 16mm Ektachrome. The producer with a low budget who requires but a few prints, will utilize 16mm color negative.

The latest information from Eastman Kodak Company indicates that the new 16mm Eastman color negative will be initially available to producers, not as regular stock, but only on special order. ■

WIDE SCREEN SYSTEMS

Continued from Page 297

0.868"x0.631". However, it is generally the practice to shoot background material with the full-screen aperture of 0.980"x0.723". This aperture is also used occasionally in wide screen color production taking the full screen aperture, after which a reduction is made for the release print. It is claimed that a noticeable gain in definition can be obtained by this reduction step for wide screen presentation. Therefore, some studios employ this method in color production in conjunction with imbibition prints.

From a negative obtained under method No. 1, contact release prints are made and the following possible projector aperture dimensions are used in conjunction with a standard 0.825" width, having a height of 0.600" for 1.33/1, 0.497" for 1.66/1, 0.472" for 1.75/1 and 0.447" for 1.85/1 release print aspect ratio. These figures represent very closely the actual ground glass markings in accordance with the respective studio policy which determines the aspect ratio to be chosen for a given picture. The above dimensions are in agreement with ASA Standards. Deviations from such are, of course, possible both at individual studios and in theatres.

It has, for instance, been followed through to reduce the height of a camera aperture to about 0.530" when shooting for 1.85/1 aspect ratio which requires only 0.447" picture information on the release print. Such technique results in wide frame line prints, not too welcome for the theatre and absolutely undersirable in regard to future TV release.

Wide Screen System No. 2:

35mm photography using a 2-to-1 anamorphic lens attachment will result in a squeezed negative indicated as No. 2, now mostly known under the name of "CinemaScope" photography.

The camera aperture used for this process can be 0.937"x0.735", which was used for the old 2.55/1 aspect ratio. This composition aspect ratio is no longer in use and is now reduced to 2.35/1 for which the camera requires an aperture of 0.870"x0.735". The ground glass markings are 0.839". x0.715", which is identical with the projector aperture as listed on the flow chart, representing a squeezed contact

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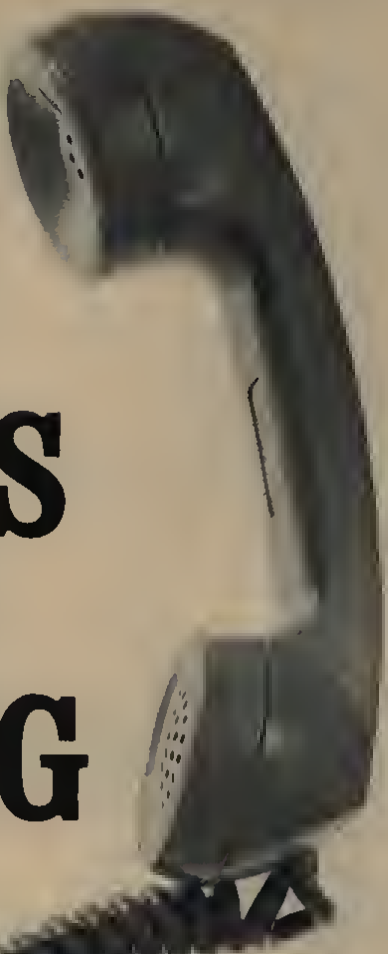

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print from the negative above.

Such prints, having a 2:1 squeeze ratio, naturally require unsqueezing in projection. It should be noted that an aperture of 0.839"x0.715" is an aspect ratio of 1.175/1, which multiplied by the squeeze ratio represents a 2.35/1 image on the screen.

Unsqueezed prints for foreign release and prints for TV can also be made from the same negative as listed under No. 2. For such flat prints the same projector apertures prevail as listed under No. 1 (Fig. 1) for contact prints of the same aspect ratios.

Wide Screen System No. 3:

The second set of flow charts (Fig. 2) represent the 35mm camera, horizontal, 8-perforation pulldown used for non-squeezed wide screen photography listed under No. 3 and for squeezed photography listed under No. 4.

Both systems utilize cameras in which the film travels horizontally at 24 frames per second with a pulldown step of 8-perforations. They are now mostly termed "double-frame" cameras. Also identical for both systems is the fact that it was recognized that picture quality in wide screen presentation is substantially increased due to the reduction step between the large area negative and the 35mm release print. Both systems, however, achieve this with no special size film since the camera uses commercial 35mm negative raw stock and related process equipment is utilized to its greatest advantage.

The unsqueezed negative for this process (VistaVision) is obtained in a camera having an effective aperture of 1.485"x0.991". For the present aspect ratio of 1.85/1 finder and ground glass markings are provided at 1.338"x 0.722". This double frame negative image is linear reduced by a ratio of about 1.6 times to a dupe negative from which 35mm, 4-perforation standard release prints are made that require no special equipment in the theatre. These prints, as indicated below No. 3 negative in the chart, are usually provided with a framing index for showing in either 1.66, 1.75 or 1.85/1 aspect ratio, for which the same projector apertures are used as listed under System No. 1 on the flow chart, Fig. 1.

Wide Screen System No. 4.

This system utilizes the same principle of large area negative as mentioned under No. 3 with the addition of a 1.5-to-1 squeeze ratio in the taking lenses. This system, now known as "Technirama," increases the versatility of the double-frame principle by providing compatible prints for both 35mm and 70mm (Super Technirama 70) release.

The effective camera aperture is 1.486"x0.992" and finder and ground glass markings are provided with lines at 1.302"x0.837" which represent the field for the 2.35/1 squeezed release in 35mm. Additional horizontal markings are provided at 1.096" to keep important action between these lines for 35mm unsqueezed prints to be released in 1.85/1 aspect ratio.

Shown on the flow chart under No. 4 is the anamorphic type release print from a Technirama negative, which is obtained by reduction printing, plus an additional 1.33/1 squeezing in the printer. With a squeeze ratio of 1.5 in the camera times a squeeze ratio of 1.33 in the printer, a squeezed print with a total squeeze ratio of 2:1 is obtained which is compatible with the anamorphic type print as listed under No. 2, with however increased definition due to the optical reduction and the step-by-step squeeze method. Unsqueezed prints also can be made from negative No. 4 by producing an unsqueezed aerial image from the original negative, out of which information is taken to satisfy a flat 35mm print that will play within the 0.825"x0.447" projector aperture.

The flexibility of the Technirama process reaches further into the making of unsqueezed 70mm prints, as is also shown at the bottom of this flow chart. The prints obtained from the Technirama negative are compatible with material otherwise obtained with a 65mm camera and printed on 70mm, using the 70mm projector aperture of 1.913'x0.868".

The third set of flow charts (Fig. 3) represent the 65mm camera, 5 perforation pulldown, nonsqueezed wide screen photography listed under No. 5, and for squeezed photography listed under No. 6. It should be noted that these systems represent an important step in large area negative photography since they deviate from the use of commercial 35mm film and utilize special 65mm film requiring not only different cameras but special processing equipment and projectors as well. In both systems the 65mm negative and 70mm release print have 5-perforations per frame and operate at 24 frames per second. (Only the first two pictures

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Wide Screen System No. 5:

The camera aperture for present 65mm unsqueezed photography under No 5 is 2.072"x0 906" as originated during the introduction of the Todd AO process The ground glass and finder markings for this camera are placed at 1 913"x0.827" which represents the field to satisfy the conditions required for the two type prints described below.

The 70mm print is a contact print having an aperture of 1 913"x0.868", which has to be smaller in width than the camera aperture since two of the six magnetic sound tracks are placed inside the perforation Actually the only difference between 65mm and 70mm film lies in the added width to the 65mm film outside the perforation Perforation center lines and pitch are identical between 65mm and 70mm raw stock.

For height composition, the 0 827" finder markings represent a compromise for the 70mm and 35mm projector apertures While the 70mm print

as described is a contact print, the 35mm print is made with a horizontal squeezing of 2-to-1 in the printer to obtain a print compatible with CinemaScope

Wide Screen System No 6:

This process utilizes a camera that is identical in every respect to the one under No 5 having an aperture of 2.072"x0.906". However, the taking lenses are designed for a squeeze ratio of 1.25/1. This process, under the trade names of "MGM Camera-65" or "Ultra-Panavision," leads to 70mm contact prints having a squeeze ratio of 1.25/1, requiring an optical unsqueezing in projection

35mm prints can also be made, receiving an additional 1.6/1 squeeze in the printer to be compatible with 2-to-1 squeezed CinemaScope type prints (1.25 camera squeeze x 1.6 printer squeeze equals 2-to-1 total release print squeeze)

The following height and width dimensions are utilized within the full camera aperture: A total height of 0.870" is used for all types of prints from the squeezed negative under No 6 Therefore, the 70mm contact print can have a projector aperture of 1.913"x0.870" which is a 2.2-to-1 aspect ratio. If such print is shown in a theatre having only a 2-to-1 screen, the width of such aperture is made smaller to satisfy an existing condition

The field for a 2.35-to-1 CinemaScope version is indicated on the finder at 1.530"x0.870"

MGM Camera-65 or Ultra-Panavision are further prepared by the squeeze in the taking to obtain a total image aspect ratio of approximately 3-to-1 which utilizes a width of 2.050" and a height of 0.870" inside the full aperture This amount of picture information can be used to display the entire horizontal field over three prints on 35mm film for multiple print wide screen systems such as Cinerama or Cinemiracle, described below

It is this type of application that allows more flexibility in projection since width can be varied without affecting the screen height. Multiple release print extraction is also possible; however this has been done only in the form of tests. When making such prints the question of film travel speed has to be settled since 65mm cameras are operating at 24 frames, 5-perforapulldown, while the release in Cinerama requires 26 frames, 6-perforation pulldown. The Cinerama *feature films* now in production and to be released shortly operate at 24 frames per second

Special Processes—Cinerama

Cinerama employs 35mm film in a special triple-camera set-up whose combined images cover 146 degrees The three prints are projected interlocked, from three separate projection booths, onto a deeply curved screen composed of 1200 vertical overlapping strips that recreate a picture very close to the scope of human vision when viewed near the center of the auditorium

Sound is reproduced from a separate 35mm film which carries seven magnetic sound tracks. Five of them feed the loudspeakers behind the screen, the other two individually feed loudspeakers on the left and right of the auditorium Loudspeakers at the rear of the auditorium are "cued" in or out as required by the action on the screen Sound is controlled by the Cinerama theater engineer who also starts the show and monitors picture brightness and focus.

Cinerama Specifications:

Camera Aperture — Three, 1.116 in. (28.35mm) high x 0.997 in (25.32 mm) wide

Effective Projector Aperture — Three, 1.088 in. (27.64mm) high x 0.985 in. (25.02mm) wide

Image Height — Equivalent to six perforations.

Aspect Ratio of Projected Picture — Varies with viewing position Is 2.06-to-1 as viewed from center projector.

Direction of Film Travel — Vertical

Rate of Film Travel — 26 frames/sec, or 146.25 ft./min.

Sound Film — 35mm full-coated magnetic, synchronized with, and traveling at the same rate as, the picture film

Cinemiracle

Cinemiracle is similar to Cinerama in principle but differs in camera and projection equipment Dimensions differ slightly and projection is from a single booth with three closely spaced projectors, utilizing mirrors. The screen is a seamless, perforated plastic one, as compared to Cinerama's 1200 vertical overlapping strip screen

Both the camera negatives and the projection prints employ Dubray-Howell perforations for precise registration. The triple camera employs mir-

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rors for the left and right images while the center picture is shot straight on. The mirrors are used to control parallax so that each panel's seams blend more precisely regardless of the distance the lenses are focused. Lenses may be focused and diaphragms set by remote control.

Sound recording and reproduction are basically the same as for Cinerama.

Cinemiracle Specifications:

Camera Aperture — 1.110 in. (28.20 mm) x 0.980 in. (24.8mm).

Effective Projector Aperture—1.090 in (27.70mm) x 0.960 in (24.4mm).

Aspect Ratio of Projected Picture — 2.33-to-1

Direction of Film Travel— Vertical.

Rate of Film Travel — 26 frames/sec, or 146.25 ft./min.

Sound Film — Separate 35mm 7-channel magnetic, traveling synchronously at the same rate of speed as the picture.

Walter Beyers original paper on the forthcoming subject was made a feature article in the *American Cinematographer Manual* Published October, 1960, by the American Society of Cinematographers. The increasing use of wide-screen systems in feature film production has resulted in increased interest of our readers in the methods, aspect ratios, etc. of the leading wide screen motion picture systems. We believe it timely therefore to reprint the article in *American Cinematographer*.—EDITOR

GLOBAL FILMING PROJECT

Continued from Page 299

unusual logistics pile-up.

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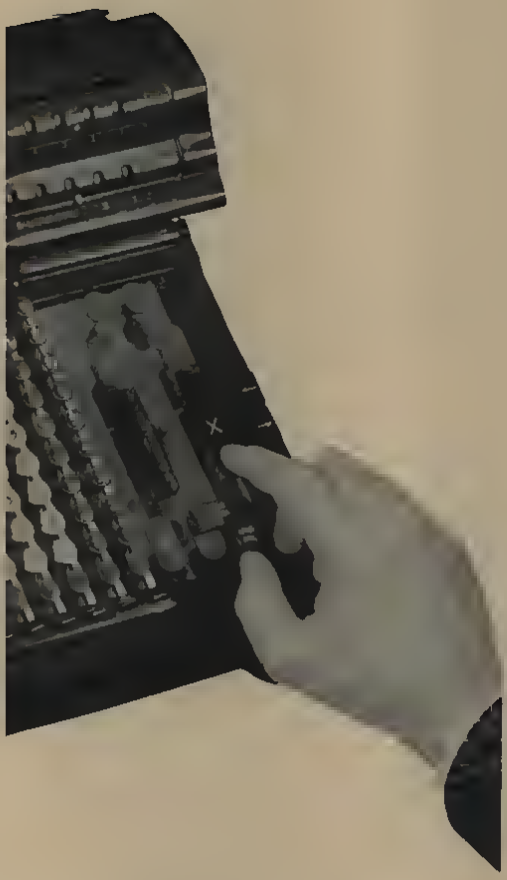

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From this vast footage, GD/A's Bruce Herschensohn and John Hynd edited the 2,000 foot hour-long "Friendship 7." Herschensohn also wrote the special music for the film and recorded it. The completed film was delivered to NASA just 36 days after Glenn's touchdown and rescue in the Atlantic. Meantime, the narration is being translated to every major language and when completed, prints of "Friendship 7" will be made and distributed throughout the world.

Not all the discoveries made in this globe-girdling project were scientific. The five-man advance team of Gene Keefer, soundman Loren Steadman, cameraman John Hynd, writer Frank Kerr and director Bill McClure, during their two months' swing around the world to make background shots and get the various tracking station recording and filming set-ups in readiness for the unified operation, discovered that the elevators in Rome were incapable of lifting five American heavyweights at one time. This happened late one night when an elevator in which the quintet was riding got stuck between floors for several hours while the city slept.

Cameraman Bob Montague, returning to Hong Kong from Australia, discovered Hong Kong is a choosy city; some pickpocket there chose his pocket to lift wallet, passport and other valuable papers.

Cameraman John Hynd discovered that the wrong color money can be confusing, although it may lead to good service. He left the wrong banknote for a tip—discovered later he gave a $13 tip for a two-bit hamburger.

In Nigeria, cameraman Bob Gohrecht learned something about Near East politics. He had a 28-day visa permitting him to work in Kano but couldn't afford to use up his precious visa time standing around waiting for the oft-postponed blastoff of the Glenn space capsule. So he traveled around Africa and Europe shooting background and other related footage. In Beirut, Lebanon, while photographing in the market place there, he was arrested for photographing without a license, and his taxi driver was arrested with him. While Bob fumed and the police fussed, the taxi meter clicked merrily on. Toward the end of the day, the Lebanese decided there was no point in furnishing dinner and lodging for their captives and so released them—one poor American cameraman and

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MOVIES IN LEGAL EVIDENCE

Continued from Page 294

should be required for the admission of motion pictures than for still photographs

Motion picture evidence may be put to a variety of uses in both civil and criminal cases Except in litigation where the motion picture itself is the subject matter of the action (suits for infringement of copyright, libel and invasion of privacy, and prosecutions for obscenity, none of which are within the scope of this article), it must be remembered that the motion picture speaks as a witness The picture describes, or redescribes, more fully and accurately, something that a witness could describe, or has already described, from the witness stand

The primary use of the motion picture is to describe an event as it actually occurred, or to show a scene as it existed at the time of the events in controversy No matter how well a witness recalls and describes a place or action that he has viewed, he may overlook some of the details. No matter what words he uses, they will not conjure up in the mind of the listener the precise picture that the witness wishes to paint It is true that the camera does not record on film the same picture that the eye transmits to the brain, but it is also true that less distortion is likely to inhere in a photographic representation of a scene than in a verbal one. In this respect the motion picture has advantages over the still photograph, for it may travel, like the eye, over the scene It is not limited to the representation of a single instant in time A motion picture camera may pan over the scene of an

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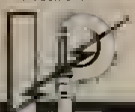

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accident showing the positions and relationships of various objects and the nature of the terrain; it may show the activities of persons, such as pickets involved in a labor dispute; or it may picture the plaintiff participating in activities which negate his claims of serious personal injury. In the criminal field, a sound motion picture of an accused confessing a crime not only is a record of that confession as reliable as a signed writing, but also indicates the conditions under which it was made and the physical and mental state of the maker in a way more convincing than would be the testimony of persons present during the confession.

Motion pictures may also be used to show a scene or action as it exists or occurs at a time different from the time at issue in the litigation. Thus, the appearance of an intersection to an approaching vehicle; the manner in which machines operate and are customarily operated, the field of vision available to a person in a moving locomotive cab; and a voluntary re-enactment of a crime by the accused may all be shown by motion picture evidence. Re-enactments, posed pic

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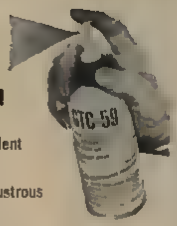

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times and depictions made at a different time from the time in issue when used as direct proof of conditions and occurrences are viewed with suspicion and received with caution. Not only must there be testimony that the film is an accurate representation of places or events actually observed by a witness, but there must also be proof that those places and events are the same or similar to the places and events in issue at the trial. If there are any differences, they must be fully explained However, such later views and reconstructions are valuable in giving the jury a clearer idea of the places and occurrences in question and in testing the accuracy of eye witnesses to the crucial events

On a different footing are motion pictures taken of experiments conducted by an expert and explained by him. Experiments illustrate and prove, to a level of scientific certainty, a number of valuable facts, and make intelligible the testimony of expert witnesses It is therefore, often desirable for an expert witness to conduct an experiment for the benefit of the jury However, the lawyer will recognize the impracticality and danger of conducting such experiments in the court room It is difficult to move and assemble the equipment often required, and disruptive to orderly procedure. Worse, mechanical or human failure, in the tension of a trial, held in a courtroom designed for other purposes, may cause an experiment to backfire —with disastrous results It is more practical and equally impressive to show a motion picture of an experiment conducted elsewhere The foundational requirements for motion pictures of experiments are the same as for films generally The experiment must be relevant to the issues helpful to the jury and not unduly prejudicial The film must be a fair and accurate record of the experiment as it was actually conducted by the expert

It has been said that motion picture evidence will have its greatest effect if shown to the jury at the end of the trial day Testimony, no matter how important, given after the showing of a film will not receive the full attention of the jury Further, the jury will look forward to the variation in trial routine and their close attention will be assured If cross-examination pertaining to the film is begun the next day, this will serve to re enforce the impression made on the jury.

The attorney should arrange for a smooth presentation of the motion picture To this end, the film may be first exhibited to the judge and opposing counsel to eliminate all objections that might interrupt the showing of the film to the jury. The opponent's experts may also view the film at this time, giving them a basis for commenting on it Even though it is decided, in the in-chambers showing, that the moving picture is admissible, the attorney should still go through the steps of authentication before the jury in order to provide an introduction to the film, to increase their attention, and to impress them with its scientific accuracy as a reproduction of the matters shown. An effective presentation will be enhanced by close cooperation, based perhaps on a rehearsal, between the witness explaining the film, the projectionist and the attorney proposing its admission

When the film has been received in evidence, depending on local practice, the trial court may allow the jury to take it with them for further viewing during their deliberations Counsel should see that the projector and screen also go into the jury room This may create a problem—one trial judge is known to have required the screen and projector to be qualified and admitted as evidence—but the court should recognize that the projector and screen are merely mechanical aids for viewing the evidence just as are a juror's eyeglasses A projectionist will not be allowed to accompany the jury, but counsel can set the film on the projector and should be allowed to show a juror how to focus it and how to run and rewind the film. ■

SUN GUN PHOTO LIGHT

Continued from Page 293

The Sun Gun Professional retains essentially the same overall design as its smaller predecessor The reflector housing or head measures 6-in wide, 4⅜-in. deep and 4-in high The housing is mounted in a U-shape yoke attached to a hand grip of generous size. The head may be tilted upwards 90 degrees or downward 30 degrees, and there is a locking device for positioning the head at any point within this arc A dimming switch mounted in the handle permits burning the lamp at ½ normal brightness both for

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When the Sun Gun Professional burns at full brightness, it produces, 65,000 center-beam candlepower of illumination having color temperature of 3400° Kelvin.

In the base of the handle of the Sun Gun a threaded recess is provided to take a conventional tripod screw so that it may be readily mounted on a lightweight tripod, music stand or Century stand. C-clamps and alligator clamps also have been used to mount the lamps on furniture, mouldings, the top of set flats, etc.

When Sylvania's engineers returned to the company plant in Salem, Massachusetts, to revise the Sun Gun for professional use, they also designed a

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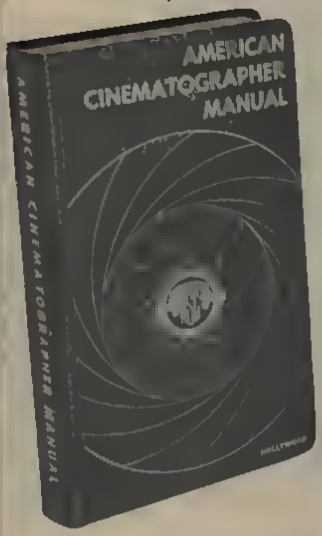

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number of accessories for the lamp. These include an accessory holder, dual-purpose flood lens portrait lens, daylight filter, 3200° K filter, a diffusing filter and mount, a 3½-in snoot, an optical "sniper" snoot, large barn doors, and a beam-spreading lens. The portrait lens, beam-spreading lens, and barn doors are standard accessories that accompany every Sun Gun Professional sold. The other accessories may be purchased separately.

Cinematographers Laud Unit

Hollywood studio cinematographers who have had opportunity to work with the Sun Guns are enthusiastic about them. Today almost every major studio has a stock of from 24 to 100 Sun Guns, some of which are used almost daily in various set lighting situations, both in the studio and on location.

Philip Tannura, ASC directing the photography of the "Shannon" TV film series at Screen Gems, used a number of the lighting units in a novel set-up which saved the producer extensive costs for process shots that otherwise would have been necessary. The script called for a series of close-ups and two-shots of actor George Nader driving a car, to be shot from the front of the car. For this, a demountable aluminum framework was constructed and mounted over the hood of the car, toward the front. It was held secure by means of large suction cups plus sturdy leather straps extending down and secured to edge of the car's fenders. On this framework was mounted a flat metal plate with provision for shifting it laterally back and forth to accommodate both closeups and two shots.

A 35mm Arriflex camera was mounted on the shiftable plate, and two Sun Guns then mounted at either side and directed toward the front seat of the car. Power for the lamps was supplied by a series of automobile storage batteries in the car's trunk. The camera, portable sound recorder, and lights were switched on and off by remote control. When only close ups were to be made, the Director sat far over in the seat next to Nader, out of camera range, and did the switching as required. When two-shots were made, the controls were handled by actor Nader.

In this remote control operation, it was necessary for Nader and the person handling the switching controls to know when the camera was turning and up to speed and also when the film ran out—for there was never an operator behind the camera, as in conventional cinematography. To provide this information, two signals were installed on the Arriflex camera—one to indicate that the camera was running, and one to indicate when the film load was exhausted. Although these details are incidental to the Sun Gun's contribution to this photographic undertaking, they are set down here for the ingenuity they reflect and also because they made possible the use of the Sun Guns in this uncommon filming situation.

When Lionel Lindon, ASC, had a series of difficult shots to make high up on the catwalks in Madison Square Garden in New York for "The Manchurian Candidate," he used a number of Sun Gun Professionals to light the unusual location.

Hal Mohr, ASC, is probably the only Hollywood Director of Photogra-

SUN GUNS NOW REPLACE battery of newsreel cameramen's lights in offices of Los Angeles Mayor Yorty, resulting in greater comfort to Mayor during news conferences and improved results in newsreel photography. Arrows point to two of the three Sun Gun installations.

phy who owns his own Sun Guns He has four—three of the early models and one Sun Gun Professional. Presently shooting various TV film commercials, Mohr finds ready use for the lamps in many filming situations, and because of their versatility they enable him to do things in lighting he was never able to do before

"The Sun Gun," Mohr says, "is the most important improvement in motion picture lighting equipment to come to my attention in more than 30 years."

William Widmayer who is credited with generating the initial Hollywood studio interest in the Sun Guns, was recently called upon to solve a lighting situation with the new lamps outside the realm of the studio sound stage. Mayor Yorty of Los Angeles, who conducts extensive press conferences in his offices, was finding it difficult to face the battery of still and newsreel cameras which were assembled before him for these weekly discussions—especially as each photographer invariably brought along and set up his own set of lights

Use Found Outside Industry

A friend of the Mayor who knew Widmayer and who had learned of his enthusiasm for the Sun Guns, prevailed upon him to survey the Mayor's quarters and prescribe a new and better lighting set up that would please the photographers, make the conferences easier on his honor, and at the same time contribute something toward improving pictorial results of the TV newsreel footage shot there

Widmayer readily solved the problem with three Sun Gun Professionals, which were mounted as in a studio set to provide a pleasing quality of photographic illumination

Columbia Studio, of course, is now perhaps the most enthusiastic user of the Sun Guns According to Widmayer, the first feature film for which the lamps were used was Columbia's "Notorious Landlady." It is not uncommon for Columbia crews to take along as many as 18 Sun Guns when shooting on location. Recently, the studio sent a crew to Hawaii to shoot a one-hour TV pilot film Heavy rains and overcast skies were encountered almost daily It was impossible to get cables, generators and heavy lighting equipment to the jungle-like location So cinematographer Scotty Welborn put

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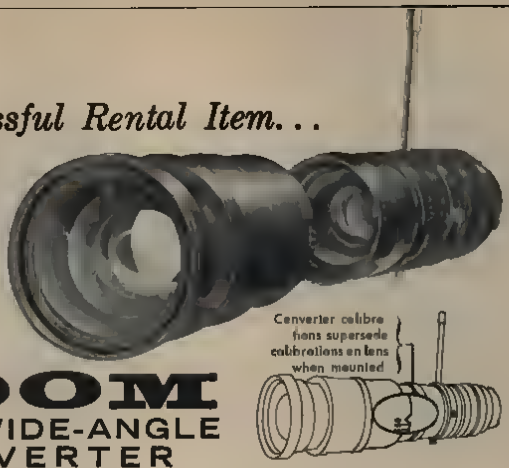

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in a call for a supply of Sun Guns and batteries to power them, and photography proceeded with no further delay.

On the sound stage, Sun Guns are regularly used whenever it is not practical or feasible to conceal other lighting units behind props, doorways, etc., for effect lighting. "The Sun Guns are ideal for this," Widmayer declares.

The advent of the newer Professional model Sun Gun promises to greatly alter set lighting procedures. Widmayer continued, and said it might very well lead to radical changes in set design if not also in the design and construction of sound stages of the future. Use of such small lighting units, he explained, would no longer require high ceilinged stages to accommodate heavy lamp equipment nor the extra stage space presently required where a great many heavy lighting units must be used on the floor. ■

[1]The British Journal of Photography, Feb. 16, 1962, pp 128

"EXPERIMENT IN TERROR"

Continued from Page 289

mented. "This was because tall buildings adjacent to the bank cut off the sunlight, keeping the areas seen through the windows in shade during most of the day. With the windows so large, it was necessary that areas beyond them look like day whenever it was necessary to shoot scenes in which these windows appear in the background."

This problem was solved mainly by arranging camera setups so the windows were eliminated in the composition. When it was necessary to shoot toward a window or the main doors, this was done at a time of day when daylight illumination of the exterior was at its brightest.

Earlier, an attempt was made to balance the dull exterior with the bright interior of the bank by flooding the adjacent buildings with light from a number of Brutes, but the effect was not satisfactory. And besides, the sight of all the lamps quickly attracted a vast throng of people to the scene which greatly hindered shooting.

The huge windows of the bank posed another problem, also. Because they admitted so much general light into the bank interior, and there was no effective means at hand to readily control it, it became necessary to gradually build up the interior lighting in the bank as the day waned and daylight diminished in order to maintain proper balance in the illumination of the great many scenes shot there throughout the day. The company worked in the bank location all of one Saturday and the following Sunday. With exception of the day exteriors, the scenes in the bank are virtually the only high-key scenes in this otherwise predominantly low-key picture.

"I would like to have used Plus X film for these bank scenes," Lathrop commented, "mainly because of the bright wall areas which have a tendency to exaggerate grain." Lathrop used chiefly Eastman Double-X negative throughout the picture.

One of the more suspenseful sequences in the picture has to do with Kelly's attempt to contact the criminal, following instructions given her by telephone. But the rendezvous fails, ironically, when Kelly not knowing whom she is to meet, mistakes a masher for him. Originally, this action was to be staged and photographed on a San Francisco cable car. But the company's preparation of cameras and lights for shooting the scenes attracted such crowds, that shooting became impossible. Lathrop estimates that by the time they were ready to shoot, more than 5,000 persons had converged on the scene to watch the company shoot movies!

The company lost no time in finding an alternative, however. Director Blake Edwards had visited the Roaring Twenties night club the night before, and quickly arranged with the management to stage the sequence of action there. The script was quickly revised so Kelly—instead of seeking her unknown tormentor in course of a cable car ride—now looks desperately for him in the crowded and dimly-lit night club. Actually, switching this part of the story to the Roaring Twenties locale was a stroke of good luck. Not only were the harassing crowds of curious entirely avoided, but the nightclub interior had many attributes not to be found in the prosaic cable car setup. The company worked in the club during the day, when it is normally closed to the public, using a group of extras, a band, and the necessary principals.

"This was a tough location to light, though," said Lathrop, "mainly because we had not planned to work here and therefore were not prepared with the necessary equipment. But we made do

Continued on Page 320

REAL COOL, MAN!

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with what lighting equipment we had, which was mostly big units—Brutes, etc Working in a confined area such as the Roaring Twenties called for much smaller lighting units—lamps that could easily be concealed yet provide effective illumination We rounded up all the Baby Juniors we could get, then made one unit do the work of two by effectively placing cutters or gobos before them to narrow the light beam or to break it up into two or more individual beams to illuminate more than one area of the scene at the same time. All in all, it took a lot of planning and we had to proceed slowly When lighting for effects in low key, as we did in the club, the procedure was necessarily more meticulous, more time-consuming than were we to light the scene in a higher key, using the larger lamps"

Toward the close of the picture, the criminal comes into the open and is now identified—at least to the audience. Assuming the guise of a woman, he intercepts Kelly in a ladies' lounge where he gives her final instructions on lifting the $100,000 at the bank and delivering the money to him in a rendezvous that night at the ballpark during the course of a game.

Shooting The Climax

The ballpark scenes were shot in San Francisco's famed Candlestick Park All were night scenes Staged as they were in a wide range of locales within the park, extreme demands were made in the lighting The action consisted mainly of Kelly walking through the corridors to her seat, watching the game, then joining the crowds in exiting the park following the conclusion of the game—all the while expecting to be contacted by the criminal. This finally takes place in a heavily crowded corridor of the stadium as throngs of spectators swarm toward the exits. As he snatches the bag containing the money from Kelly. FBI agents who have converged on the park, spot the criminal and give pursuit—failing, as seems customary in today's movie chase scenes, to nick him in the initial fusillade of pistol shots. The criminal dashes out on the playing field, now completely emptied of players, and finding himself surrounded by FBI agents—some overhead in a helicopter, which now descends toward him—he attempts to shoot it out with them and is killed.

All photography in the passageways of the stadium, in the latter part of this sequence, was done with the camera mounted on a skillfully manuevered dolly. Because of the low ceilings and the lack of places to conceal lighting units Lathrop had to work with a minimum of light in the corridor scenes—something like 50 foot candles. Out on the ball field action staged there of the criminal dashing out and attempting to escape was amply lighted by the park's illumination system, which provided light volume close to 200 foot candles in the area of the pitcher's box From here it diminished gradually to around 50 foot candles in the extreme far reaches of the field

Aerial Shots

The helicopter previously mentioned was used both as a participant in the action and as a mobile camera mount for impressive aerial shots of such proceedings as the tailing by an FBI car of a car driven by Kelly and again of a taxi in which she is riding. (Throughout the picture, the FBI closely guards Kelly day and night, both to protect her from harm and to track down the criminal) Also for shots of the criminal as he dashes out on the ballpark playing field, and as he attempts to shoot down the helicopter (in its other role) as the FBI closes in on him A hand-held 35mm Arriflex camera, fitted with two gyro stabilizers, was used in making these latter shots

One of the more interesting photographic innovations was that used in photographing a scene in which the criminal attempts to intercept Kelly's sister walking home from school The object was to capture, virtually in one continuous shot, the whole action as observed from the position of the criminal seated in a car parked at the curb The girl is approaching from behind, and he watches her progress intently in the car's rear view mirror

Two key items were used in making this shot—a zoom lens and a partially curved mirror, similar in design to a conventional rear-view mirror. but

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slightly larger With the camera mounted behind the killer, looking over his shoulder, the lens was zoomed down sharply to take in the scene in the mirror showing the girl approaching from behind, then as her image exits from the mirror area, the lens was zoomed back to take in the whole car and the sidewalk beyond as the girl comes into the picture The effect is similar to a moving camera shot made from an automobile traveling on the street slightly ahead of the girl. The whole thing is so expertly devised and executed that few persons are aware that it is anything but straight forward photography Nor was the shot planned and included in the script. Like so many of the photographic innovations that mark this picture, it was a spur-of-the-moment thing, Lathrop explains

As for other technical details of the picture's photography, 90 per cent of "Experiment in Terror" was shot with a 30mm lens "I don't think I ever used a three-inch lens on the picture, except perhaps once: for the 'big nose' closeup of the criminal, but that's all," Lathrop said.

Space does not permit detailing the photographic and lighting procedures for numerous other outstanding scenes in this picture. It is just as well, perhaps, for it leaves the reader with ample areas to explore himself in seeing the picture on the screen—a "must" for students of cinematography and others for whom a genuinely imaginative job of black-and-white photography is a delight.

Wherever possible, Lathrop explained, the photography of "Experiment In Terror" was kept in low key to sustain suspense. "Our aim was to make the audience feel that every time Kelly walked into a dark area her pursuer would suddenly appear and pounce upon her."

Continuing, Lathrop said: "At the studio we worked at an average of 100 foot candles of illumination, at f/5.6, using Double-X film. We alternated between Plus X and Double-X, depending on the situation No Tri-X was used at any time; I consider it too grainy for general use I feel that Double-X has replaced it for most critical photographic situations."

Lothrop, ASC Freshman

Philip Lathrop is ASC's most-recently admitted member, having been on the Society's Roster only about a

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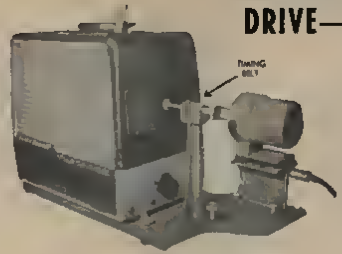

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year. He started his cinematographic career as a film loader at Universal Studios in 1935, which job he pursued for five years. He was subsequently elevated to assistant cameraman and worked mainly with the late Joe Valentine. After ten years as an assistant, he worked the next ten as an operator for Russell Metty, ASC, then became a director of photography.

He was placed under contract by Universal, parted with that studio when it was sold to Revue, then followed the general trend of cinematographers to TV filming. He directed the photography of most of the "Peter Gunn" shows, all of the "Hong Kong" and "Mr. Lucky" shows, then returned to working with Blake Edwards whom he had first met at Universal. He considers his years of TV film photography valuable training for his present pursuit—photographing feature films. In shooting TV films he found unlimited opportunity to experiment with lighting effects and camera techniques.

Today, he is doing things in the photography of "Days of Wine and Roses" at Warner Brothers that he first developed and used when shooting films for television. ■

—Arthur E. Gavin

BEHIND THE CAMERAS

Continued from Page 2R6

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